Evaluation of ZCOM

INPUT

Z-COM
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1 INTRODUCTION

I INTRODUCTION

A. OBJECTIVE

- This study was commissioned on August 8, 1984 by J.R. Hiatt, Director of Planning and Services, TRW, One Space Park, Redondo Beach, California. The objective is to evaluate Comserv Corp., a supplier of proprietary computer application software products and services to the manufacturing industry. The company is traded on the NASDAQ exchange, symbol CMSV.

B. METHODOLOGY

- The evaluation was carried out on four levels:

  - Face to face and telephone interviews with Comserv.

  - By Peter Cunningham, President of INPUT and Graham Kemp, Vice President of INPUT, aimed at evaluating Comserv management quality, cohesiveness and understanding of their market and competition.

  - Telephone information with the top seven vendors in the manufacturing applications software market (Comserv again included) to evaluate market share, trends, vendor strategies in targeting the manufacturing

software market, size of user company, price sensitivity and product development plans.

- Telephone interviews with 36 users of MRP packages from these same vendors, to assess their reasons for choosing a particular vendor, satisfaction level with vendor support, expenditures on post sale support activities, plans for additional software module purchases etc. (See Exhibit I-1 and I-2 for details.)

C. USERS OF THIS INFORMATION

- INPUT has presented the findings of this study at TRW in Redondo Beach, CA on the 27th of September, 1984. It is presumed that TRW will exercise whatever control over the information that is deemed appropriate. INPUT has delivered five copies of thie report to Mr. J.R. Hiatt. Additional copies can be ordered through him.

EXHIBIT I-1

USER INTERVIEW SAMPLE SIZE

BY INDUSTRY SERVED	
Discrete Manufacturing	21
Process Manufacturing	11
Services	4
Total	36

BY COMPANY SIZE	
< $10 Million	3
$10-50 Million	3
$50-100 Million	8
$100-500 Million	8
$500+ Million	9
Not Given	5
Total	36

EXHIBIT I-2

USER SAMPLE BY VENDOR

VENDOR	PRODUCT	NUMBER OF USER SURVEYS
Comserv	AMAPS AMAPS/3000	15
ASK	MANMAN	4
Cullinet	CMS	3
IBM	COPICS	3
MSA	MRPII	4
Martin Marietta	MASII	3
NCA	MAXCIM	4
Total		36

II EXECUTIVE SUMMARY

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- This Executive Summary is designed to help the busy reader to review the research findings of this report without having to read the detail of each section, while ensuring that the key points are not missed. Each main point is summarized as an exhibit and an accompanying text is given on the facing page. This facilitates the user of the Executive Summary as an in-house overhead presentation.

- The general concensus of all of the applications software companies active in the manufacturing industry was that business growth is expected to be substantial:

  - Majority of manufacturing companies are entering a steep growth curve and are looking to improve their ability to monitor and control that growth through improved information management.

  - Those manufacturing companies that are in trouble are also expected to be good targets for such application software products: they need a better fix on where they are.

  - Growth varies significantly from one vertical market to another within the manufacturing sector: it is therefore imperative for vendors to carefully segment their markets and begin reviewing the packaging of their products in view of the specific requirements of each market segment; this enhances the product's competitive profile and improves the hit ratio.

- Overall the manufacturing application software market is not a price sensitive market; the positive payback from implementation of these system is so far off the scale that cost is rarely a factor.

A. MARKET SIZE AND GROWTH RATE (1984-1989)

- Exhibit II-1 summarizes the user expenditures on MRP systems and services. As can be seen Integrated Systems (i.e., turnkey systems) and Remote Computing Services (RCS) easily dominate, although the Integrated Systems line includes the value of the hardware sold with the system (which is worth approximately 60% of the values shown).

- (Note: after verification and contrary to the opinion expressed during the presentation, there is no double counting between the value of software included in the Integrated Systems line and the systems or application software values shown).

- The overall growth of the applications software market understates the growth of the main vendors (top seven) due to;

  - Price reductions expected in the micro-based applications software products which undervalue the growth in the number of sites.

  - The impending consolidation of the vendor community by mergers, acquisitions and company failures which will momentarily affect the market growth.

- Also INPUT prefers to make a conservative growth expectation which has strong chances of being exceeded, rather than provide an inflated forecast which has to be regularly reduced. We recognize that forecasts are frequently

EXHIBIT II-1

MRP II USER EXPENDITURES
BY DELIVERY MODE

DELIVERY MODE	($ MILLIONS)						PERCENT 1984-1989 AAGR
	1984	1985	1986	1987	1988	1989	
Totals							
RCS	$ 285	$ 333	$ 364	$ 392	$ 438	$ 509	12%
Batch	128	118	109	95	82	73	-11
Integrated Systems	331	441	530	616	759	967	24
Systems Software	269	333	399	463	532	633	19
Applications Software	187	236	299	369	427	523	23
Professional Services	267	299	345	374	416	491	13
Total	$1,467	$1,760	$2,046	$2,309	$2,654	$3,196	17%

used for major decisions such as market entry, capital investment and acquisition and therefore should not be optimistic.

- The exhibit demonstrates the importance of participating in as many of the MRP sub-markets as possible: a Comserv restricted to application software could be in a relatively small market. The addition of turnkey systems and professional services more than triples the potential market.

B. MAJOR VENDOR MARKET SHARES

- Exhibit II-2 attempts the comparison between the non-captive revenues produced by each major vendor (i.e., those revenues that are from competitive, open-market sales). This is a difficult task because it relies on estimates of that proportion of each vendors revenue. Nevertheless it is the only interesting comparison that accurately reflects the competitive strength of each vendor.

- Comserv emerges as a strong contender in the marketplace, but it is a position that is being steadily eroded:

  - Ask computer is well within striking distance and is expected to grow much faster than Comserv over the next four years.

  - NCA is close in revenues and growing even faster than Ask.

- It would be correct to point out that Comserv is predominatedly active in a market that neither Ask nor NCA address: the IBM systems market. However this is a "good news-bad news" situation. The good news is that they don't meet in this market. The bad news comes in several parts:

EXHIBIT II-2

VENDOR MARKET SHARES
MRP SOFTWARE AND SERVICES, NON-CAPTIVE

VENDOR	FISCAL YEAR END	1983 ESTIMATES ($ Millions)	MARKET SHARE (Percent)	EXPECTED PERCENT GROWTH 1984
IBM	December	$38.0	25.0%	18%
Comserv	December	19.4	12.8	20
ASK	June	19.0	12.5	40
NCA (1)	December	14.1	9.3	25
Martin Marietta	December	12.5	8.2	22
Cullinet	April	8.0	5.3	30
McAuto	December	7.0	4.6	20
MSA	December	5.0	3.2	35

(1) Includes $4.7 Million CAD Verification

- Comserv is not active in the fastest growing MRP market: the DEC-based systems market; (NCA ana Ask both are).

- The competition in the IBM-based systems is strong: IBM themselves, Cullinet (the world largest supplier of DBMS systems) and MSA, the leading independent applications software vendor.

- The order shown in Exhibit II-2 is therefore a momentary one which is already undergoing significant change.

C. COMPETITIVE ANALYSIS

- Despite all of the talk about competition in the MRP market, in reality there is little head-to-head confrontation for many of the vendor, as shown in Exhibit II-3.

- NCA concentrates on start ups in the Discrete Manufacturing market, a market that is largely untapped and totally ignored by all other MRP vendors (much to NCA's delight, growth and profit); in addition NCA concentrates on DEC VAX-based systems.

- MSA aims at Fortune 2000 Discrete Manufacturing companies plus process manufacturing that are larger than $100 million sales, all on IBM mainframes.

- McAuto aims at small Discrete Manufacturing companies (over $10 million sales and up) on DEC, IBM and DG equipment. The company is not considered a major competitor by other vendors.

- IBM sells mainly to "IBM shops" (companies who take IBM products as a matter of company policy, not because they are competitive).

EXHIBIT II-3

VENDOR SUMMARY

VENDOR	TARGET MARKET	HARDWARE	CAD/CAM	CIM	MAIN COMPETITOR	IBM PC AT	GROWTH
NCA	Start-up Discrete Mfg.	DEC VAX	No	In Development	ASK	Not Useful	25%
MSA	Discrete Mfg. + (lately) Process Mfg. >$100 M	IBM Mainframes	No	In Development	Comserv	Very Useful	35%
McAuto	Discrete Mfg. >$10 M	DEC/IBM/DG	Yes	Yes	None (!)	No Plans	20%
IBM	Discrete Mfg. >$20 M	IBM	No	None	N/C	Will Integrate	18%
Cullinet	Discrete Mfg. >$50 M + (lately) Process Mfg.	IBM/PCM	No	Plan to	MSA	Will Integrate	30%
ASK	Discrete Mfg. >$10 M	HP/DEC	No	Plan to	NCA	Will Integrate	40%
Comserv	Discrete Mfg. >$20 M Process Mfg.	IBM/HP	No	In Development	Cullinet	Important for Departmental DP	20%

SOURCE: Vendor Interviews

Although this takes business away from the vendor it is not exactly open-market competition.

- Then there are those vendors that are not only strong competitors but are big enough targets to be competed against:

  - Ask is the premium HP (and now DEC)-based systems supplier. As such, Ask competes strongly against NCA (DEC) and Comserv (HP) and will become more and more a factor as it strives to maintain 40% growth per annum.

  - Comserv is a clear target for MSA, Cullinet and Ask. This may account for its relatively slow growth (27% this year).

  - Cullinet is a formidable current and future competitor for MSA, IBM and Comserv and has the best opportunity of offering a new solution to the CIM problem: integration around the excellent data base that Cullinet offers, supplemented by application-specific solutions for MRP, CAD/CAE and financial control.

D. MARKET TRENDS AND ASSESSMENT OF COMSERV

- The trend of the market is towards increased competition, rapid development of DEC-based solutions, integration of post-sales support services (training, consulting, maintenance, customization, add-ons, documentation) and on-line support of all of these forms of service. Manufacturing applications software vendor must understand they are not selling a product or a solution, but a service.

- This essentially means that training, consulting and maintenance, to name a few, are continuous functions not discrete functions. From the moment that a

customer is sold either software or a turnkey system he/she becomes "live" and stays "live" throughout the life of the system. This will prepare the client for future systems such as CIM where operations integration will mean that half an hour's downtime of the system will mean that the whole company is incapacitated.

- The pace of market development is expected to increase rapidly in the near term as vendors jostle for market position and product competitive advantage. This will require almost continuous product development/ innovation and a strongly motivated management team (as well as financial strength).

- Comserv has shortcoming in all of these areas (but so do many of the other vendors):

  - No DEC version of the AMAPS product line (this must be remedied immediately).

  - Good quality training and professional services capabilities, but both are perceived as standalone services.

  - No ability to precede or follow the need for continuous development of the existing software modules, let alone new ones.

  - Poor financials, which has led to an inward-focused management team.

- Exhibit II-4 summarizes the positive and negative factors of Comserv relating to the above market trends.

EXHIBIT II-4

EVALUATION OF COMSERV OVERALL SUMMARY

- Positive
  - Technically Strong; Good Middle Management
  - Good Product, Market Image and User Base
  - Depth in Professional Services and Education
  - Strength in Discrete Manufacturing and Process Manufacturing

- Negative
  - Managerally Weak at the Top; Poor Control of Strong Growth
  - Has Sold to MIS Managers; Must Now Sell to Vice-President Levels and Comserv Apparently has Trouble Doing This
  - Weak Financials Impacting Company Internally, (Morale, Growth)
  - No VAX-Based Products: Major Shortcoming in Manufacturing Environment Where DEC is Strongly Implanted
  - Future Market Growth and CIM will Require Substantial Investment which Comserv Cannot Generate Iternally

III ANALYSIS OF COMSERV

III ANALYSIS OF COMSERV

A. OVERVIEW

- It is tempting to categorize Comserv as a company who's time has come--and gone. This would be unfair in several respects:

  - Comserv has an excellent reputation in its field both with the user base and with its competitors.

  - An installed base of 450 users has substantial long term value.

  - The products are good.

  - Technically, the company is strong with a nucleus of good middle management.

- However, the negatives are beginning to accumulate:

  - Debt is high.

  - The company has lost momentum, internally and externally.

  - The management, particularly the highest levels, lacks conviction and does not impart direction.

- Comserv is letting the DEC-based market opportunity pass it by with no attempt to participate in it.

- The company is not generating the funds required to continuously upgrade and expand its products, which will therefore decline in competitiveness over time.

- INPUT believes Comserv still has potential, but in order to translate this potential into profits the company needs three things:

  - A capital injection to reduce debt and provide operational funds for the remainder of 1984 and at least the first quarter of 1985.

  - Strong managerial direction (not available internally).

  - A partner with excellent public image value to dispell the doubts that have arisen as to Comserv's survival.

B. FINANCIAL PERFORMANCE

- Comserv's financial performance has been adequate if not spectacular from 1977 through 1981, providing earnings at 8% of revenue (11.6% in 1981). This is below the performance of other applications software companies who have far exceeded Comserv's 60% per annum revenue growth and produced earnings at or above 20% of revenue.

- In 1982 two significant changes altered this profitable picture:

  - Comserv began to feel a slow down in orders (revenue grew only 27% or half the usual rate).

- Comserv decided to build its own $15 million headquarter; for a company that had cumulative earnings since inception of around $4 million this was, to to say the least, inappropriate; 1982 earnings duly reflected this incredible move: down 74%.

- In 1983 the contraction in orders continued: revenue fell 11% and earnings plummeted to a $10.5 million loss. Managements reaction was predictable: it burdened the company further with a $13.25 million mortgage loan agreement with Teachers Insurance Annuity Association of America, guaranteed by its new headquarter facility (purchased with the majority of the proceeds from $20 million of 11% convertible debentures due July 1, 2002).

- INPUT believes that Comserv's revenue contraction is over. In the first six months of 1984, revenue was $11.8 million (see Exhibit III-1). This was accompanied by a six-month loss of $4.7 million. The trend, however, is upward in revenue and earnings. INPUT believes that Comserv will have revenues of $6 million and $6.9 million in quarters three and four respectively of 1984, producing a loss of $.08 million in quarter three and break even in quarter four (see Exhibit III-2).

C. COMSERV RELATIONSHIP WITH CDC

- As cash flow problems continued to mount Comserv sought to find a backer or, preferably, an acquirer. In addition, an immediate loan was necessary to continue operations. CDC provided a partial answer to all of these.

- The specifics can be summarized as follows:

  - Two million dollar cash loan secured by ($8 million) receivables and land.

EXHIBIT III-1

COMSERV FINANCIALS

(Restated as of August, 1984)

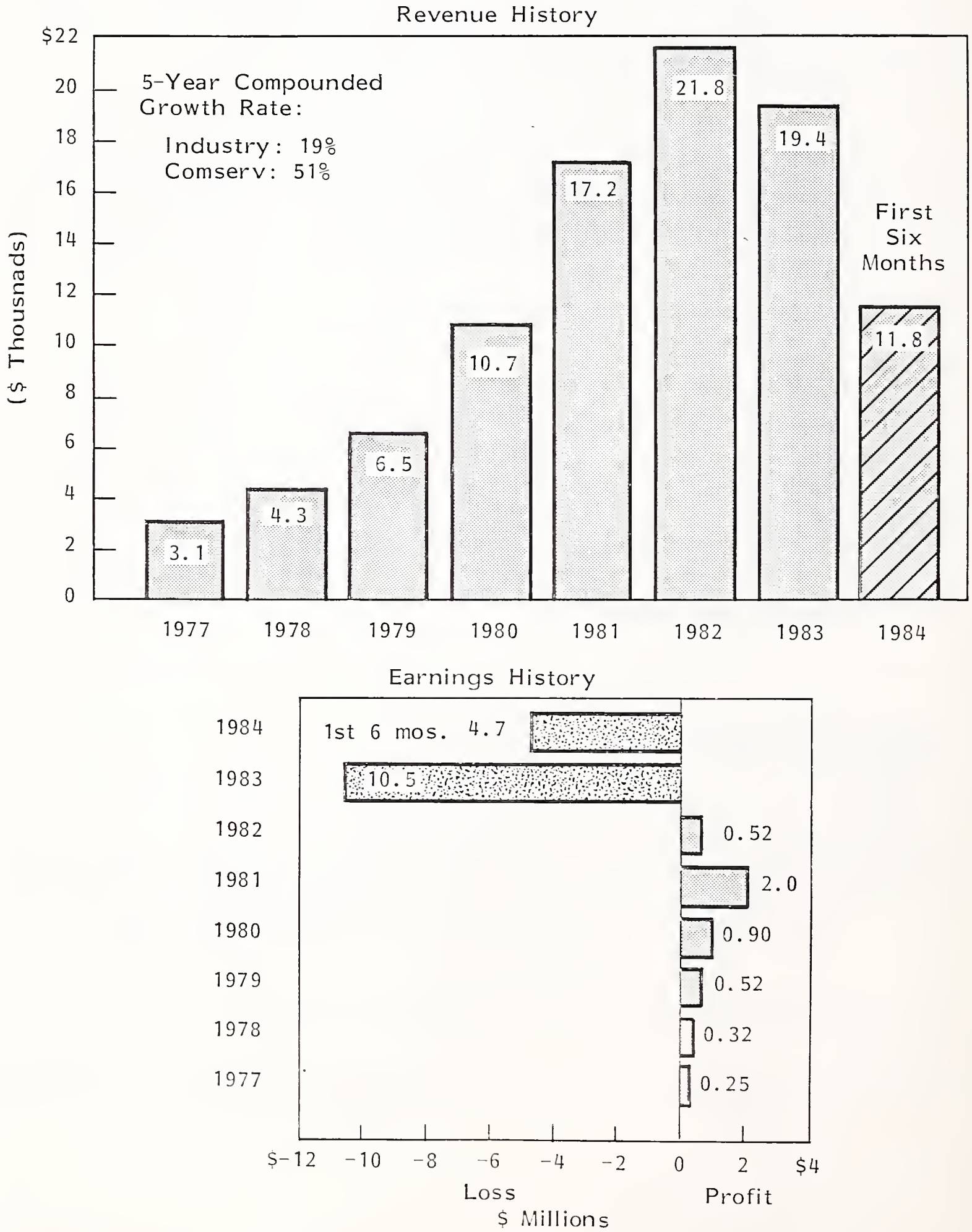
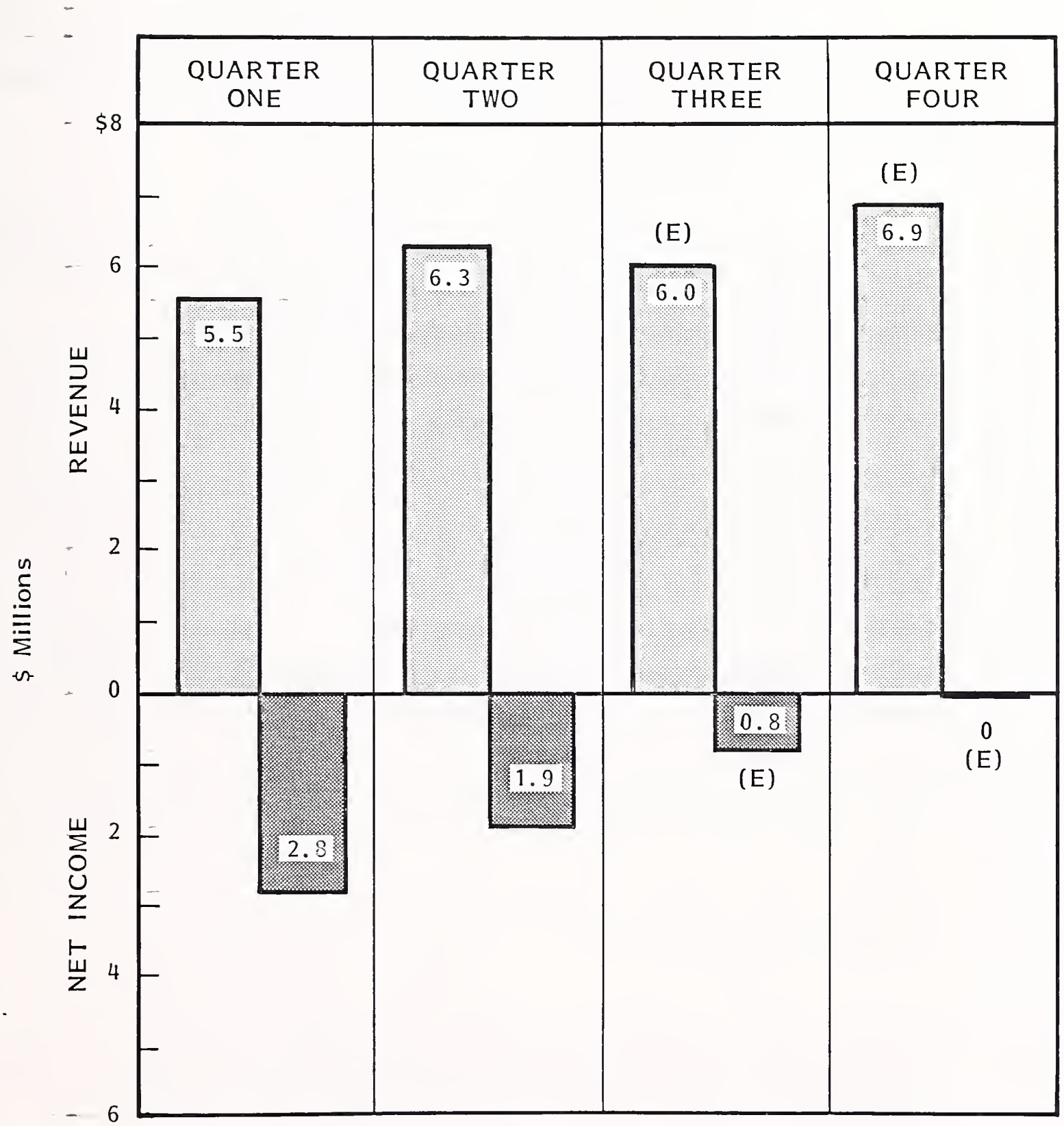


EXHIBIT III-2

COMSERV 1984 FINANCIALS



- Option to acquire 20% of Comserv though new convertible preferred stock (cost: $1 million).

- Four-year option for further 20% of same, starting January 1, 1985 (cost: $500,000). Both options are still pending shareholder approval.

- Plus:

  - Intent to obtain nonexclusive international marketing rights to AMAPS with Comserv's international efforts rolled into CDC.

  - Marketing rights to manufacturing software, educational programs for international markets.

  - Study of feasibility of converting AMAPS to CDC Cyber Series. No obligation on either party.

- The significant aspect of all of these points is that the stock options are pending stockholder approval. Therefore it is still possible for TRW to cancel these options (at a cost of $1.5 million--the amount paid by CDC for the options). All of the above items under "PLUS" are in effect "wish-list" items with no specific value, schedule or concrete intention attached to them.

D. SUMMARY EVALUATION

- Comserv an be leveraged into a first class competitor in the manufacturing applications software market. But the list of proviso's is long:

  - Restructured top management with a clear strategy for their market into the 1990's (very important; significant changes in product requirements, competition and marketing strategy will be needed).

- Immediate development of DEC-based AMAPS product line: it will take at least a year to produce product, which is a long enough absence from this vital market.

- Reinforced sales structure: it appears that Comserv has sold (successfully) to MIS managers; as integration grows vice presidents and above are more and more involved in the purchase decision and Comserv appears to have difficulty doing this.

- Reduced lag time (defined as the time between user starting evaluation of the product and the purchase decision): Comserv has the longest lag time of any of the top seven vendors in this market, which contributes to higher than necessary sales costs and lower than necessary revenues. (This is tightly linked with the reinforced sales structure.)

- Cash injection of $9 million: this is composed of $1.5 million to eliminate the CDC stock options, $2 million to repay the CDC loan, an estimated $3 million for operations through the end of quarter 1, 1985 (when Comserv should begin producing cash again) and estimated $2.5 million needed to develop DEC-based AMAPS, AMAPS/Q products.

- Take over by a respected company: Comserv needs to publicly reassure its prospects and users that its survival has been ensured. Certainly TRW's reputation fits the bill. Currently the markets perception is that CDC has fulfilled that role.

- Comserv's current line is satisfactory for the markets that it targets. However, it will rapidly become necessary to target vertical markets within the discrete and process manufacturing sectors. This implies additional marketing and sales effort and some module modification/tailoring to make the standard vanilla versions look like vertical market-specific solutions. This effort will be well rewarded in greater competitiveness, higher hit ratio, increased sales, revenue and profits and easier prospect targeting.

- The window of opportunity for making all of this happen is small and getting smaller. If the CDC stock options are allowed to go through stockholder approval, any acquisitions of Comserv would mean paying CDC a premium. This means action within the next 60 days.

IV MANUFACTURING APPLICATIONS SOFTWARE VENDOR ANALYSIS

IV MANUFACTURING APPLICATIONS SOFTWARE VENDOR ANALYSIS

A. VENDOR PROFILES AND PRODUCT DESCRIPTIONS

1. ARTHUR ANDERSEN & CO.

- Arthur Andersen's Manufacturing Planning and Control System--known as MAC-PAC--is included in the report because it is a direct competitor of the Comserv AMAPS product line. Both MAC-PAC and AMAPS operate on the same hardware (IBM large systems, and HP-3000s), they are written in the same programming language (COBOL), and they appeal to the same type of customer (medium to large discrete manufacturer). It is safe to say that MAC-PAC and Comserv are competing for the same customer.

- One of the major advantages of MAC-PAC is the fact that the program has been developed around a DMBS, but is independent of the DBMS. IBM systems usually have the IMS data base manager while HP uses the IMAGE DBMS (MAC-PAC has been installed with other DBMS packages). DBMS flexibility is interested in the company's marketing literature.

- Another advantage Arthur Andersen has over some other manufacturing software vendors is the extensive number of related software packages the company offers. These include:

- FIN-PAC (Financial softwrae).
- Distribution Control System.
- Marketing Analysis System.
- Material Management Information System.
- Employee Information System.

- A disadvantage Arthur Andersen has in the manufacturing software market is basic inexperience in the industry. Although MAC-PAC was introduced in 1978, only 90 packages have been sold despite the fact that Arthur Andersen's package is significantly less expensive than Comserv's.

- MAC-PAC is an integrated group of eleven modules including:
  - Master Scheduling.
  - Design Engineering.
  - Manufacturing Engineering.
  - MRP.
  - Inventory Control.
  - Purchasing.
  - Capacity Requirements Planning.
  - Shop Floor Control.

- Labor Performance Reporting.

- Product Costing.

- Inventory Accounting.

2. ASK COMPUTER SYSTEMS

- Ask Computer Systems, Inc. develops and markets manufacturing software for DEC VAX superminicomputers and Hewlett-Packard minicomputers. The Los Altos (CA) based company was incorporated in 1974 and had fiscal 1984 (ending June 1984) revenues of $6.5 million, up 65% over 1983 revenues of $39.2 million.

  - The company's major product is its ManMan (Manufacturing Management) software. This product is aimed at manufacturing companies with revenues of from $0 to $100 million per year and can be accessed in any one of three ways including: 1) a complete turnkey package, 2) software alone to be used with the customers' current HP or DEC equipment, or 3) on a timesharing basis through the ASKNET system. This last option is designed to attract the low-end of the manufacturing market--companies with revenues of under $10 million. Timesharing costs approximately $3,000 per month as opposed to the $150,000 to $300,000 outright purchase price for ManMan.

- With over 500 product installations, Ask is well established as one of the market leaders in manufacturing software. The vast majority of installations are on HP equipment, however sales of software for DEC VAX equipment is increasing rapidly. Sandra Kurtzig, CEO at Ask, has indicated that DEC-based sales should equal HP-based sales by late 1987. (DEC-based sales were reported to represent less than 5% of overall sales in fiscal 1983).

- The successful introduction of DEC-based manufacturing software was extremely important to ASK because it broadened the company's target market--a major step towards meeting Kurtzig's stated goal of becoming a $100 million company. Based on the success of the DEC project, Ask is reportedly considering the development of IBM-compatible ManMan software. If this happens (a decision is scheduled for late 1984), Ask will directly compete in both of Comserv's major markets.

- Ask is not successful in all its ventures, however, as evidenced by the termination of their micro operations in 1984. Ask originally acquired Software Dimensions in June 1983 and renamed the subsidiary Ask Micro, Inc. The micro line of accounting software was expected to contribute to a micro-based ManMan product, but distribution problems and persistent losses resulted in termination of the project.

- It is significant that Ask abandoned its microcomputer venture so soon after the introduction of DEC's Microvax minicomputer. INPUT expects Ask to utilize the Microvax to access the low end of the market now served by companies such as MDS Qantel.

- ManMan software consists on 12 modules which can be sold separately or together. These include:

  - MANMAN/MFG.

    . Inventory Control.

    . Bill of Material.

    . Work in Process/Shop Floor Control.

    . Purchasing.

  - Cost Accounting.
  - MRP/Capacity Requirement Planning
  - Scheduling.

- MANMAN/OMAR
  - Order entry.
  - Shipping.
  - Accounts Receivable.
  - Sales Analysis.

- ManMan/Omar Plus.
  - All of OMAR.
  - Inventory Control.
  - Purchasing.
  - Cost Accounting.
  - Scheduling.

- ManMan/AP.
  - Accounts Payable.

- ManMan/GL.

  . General ledger.

  . Financial Statement.

- ManMan/FA.

  . Fixed Assets Tracking.

  . Depreciation Processing.

- ManMan/Planman.

  . Visicalc Financial Modeling.

- ManMan/Payroll.

  . Payroll.

  . Checks and Deduction.

- ManMan/Serviceman.

  . Service Contract Maintenance.

- ManMan/Serviceman Plus.

  . Service Contract Maintenance.

  . Inventory Control.

  . Purchasing.

. Cost Accounting.

. Scheduling.

- ManMan/Grafman.

. Business Graphics.

- ManMan/Quiz.

. General Purpose Report Writer.

3. COMSERV CORPORATION

- Comserv is regarded by competitive vendors as a market leader in manufacturing software for three reasons:

  - The company's software product (AMAPS) is one of the oldest (introduced in 1976) and best developed manufacturing software packages.

  - AMAPS products are among the most flexible in terms of hardware requirements.

  - Comserv has one of the largest dedicated user bases in the industry.

- The company's status as a market leader, however, is being tarnished by a poor financial performance. Revenues for the fiscal half of 1984 (ending in June) were up 14% (to $11.8 million) over the comparable period in 1983, but the company reported a net loss of $4.8 million so far in 1984. When the company recently restated revenue and income results for 1981-1983, its auditor, Peat, Marwick, Mitchell & Co., indicated that they had been "misled" and resigned as Comserv's auditors. The securities and Exchange Commission in investigating the restated revenue figures.

- Sales have been effected by the adverse publicity, admitted a company representative, but Control Data Corporation's recent loan of $2 million seems to have defused the issue, at least temporarily. Currently, Comserv has just over 300 clients for installed products and over 700 timesharing customers.

- AMAPS, and its predecessor MAPS, is Comserv's major product. AMAPS is designed to run on large IBM and plug-compatible mainframe. AMAPS/3000 is designed to run on Hewlett-Packard HP 3000 minicomputers and is an expanded version of the original AMAPS software. The company also marketed AMAPS software for Prime and Wang minicomputers. (Prime and Wong software has not been upgraded for two years, however, and is not being sold to new customers.) In addition, Comserv is said to be working on an AMAPS version for the CDC Cyber mainframe as a result of the company's financial arrangements with CDC, mentioned above.

- In order to ensure system flexibility, Comserv has reached agreements with Applied Data Research and Software AG permitting Comserv to market the data base management systems offered by these vendors in conjunction with AMAPS. The DBMS packages are offered at reduced packages when used only with AMAPS and are installed by the data base vendors.

- Unlike some of the competitors, Comserv has chosen to specialize in manufacturing software. The AMAPS (standing for Advanced Manufacturing, Accounting, and Production System) has been upgraded almost continuously since its initial introduction in the mid 1970s and currently offers 15 interactive modules of software for medium and large manufacturing companies (i.e., companies with revenues over $20 to $25 million per year).

- AMAPS modules include:

  - Bill of Material.

  - Material Control.

- MRP.
- Purchasing Control.
- Process and Routing.
- Shop Floor Control.
- Capacity Requirements Planning.
- Standard Costing System.
- Master Production Scheduling.
- Lot Traceability System.
- Cost Management System.
- Multiplant (a special AMAPS option that allows multiple plants to be incorporated into a single AMAPS data base).

- AMAPS/3000 includes all of the above modules as well as:
  - Order Management System.
  - Financial System (including Accounts Receivable, Accounts Payable, and Geneal Ledger).

- Education and Training represents one of Comserv's major competition advantages according to the company's respondent. Over 15% of the company's revenues are derived from educational services--up from 4% in 1980. In addition, educational services are very profitable in that they requre little or no maintenance despite the fact that the market for these services is growing rapidly.

- Comserv has a well developed educational program which include video and self-placed education in addtion to the more traditional in-class instruction. The company feels that education is a good sales point and can be used to leverage additional sales. With the growth of CIM, Comserv feels that more and more workers will need to be retrained to use the new equipment—opening a potentially huge market for which competition is not yet prepared.

4. CULLINET SOFTWARE

- Cullinet Software was founded in 1968 and is known primarily as an integrated data base management software (IDMS) developer and vendor. In 1980, however, the company entered the applications software environment with a general ledger package acquired from McCormack and Dodge and a manufacturing system from Rath and Strong. Continued acquisition of application sosftware, such as the recent agreement with banking software developer Bob White computing and Software, is expected. Chairman of the Board, John Cullinane has indicated that by 1987 50% of Cullinet revenues would be derived from applications software roles.

- One of the major advantages Cullinet has over other manufacturing software vendors is the Westwood (MA) company's experience with data base development. Many vendors feel that the limited capacity of today's relational data base is the major factor inhibiting the development of a true computer integrated manufacturing unit. Cullinet feels that its manufacturing software product takes full advantage of the lastest data base technology while other MRP II vendors are relying on remarked 1970's technology.

- The company's financial performance in fiscal 1984 (ending in April) tends to justify Cullinets optimum. Revenue for 1984 was $120 million, 53% ahead of 1983. Net income increased 43% to $16.5 million. Application software is the company's fastest growing product line and currently represents about 20% of total revenue. Manufacturing products have been installed at over 70, sites up from 50 in 1983.

- While Cullinet has been successful in the integration of acquired application programs with their own data bases management systems, this strategy highlights the fact that Cullinet has little or no background in the manufacturing software market. This lack of background in manufacturing is seen by several vendors as a distinct disadvantage to Cullinet and one major reason that the company's products are not as complete as the current market leaders.

- All Cullinet applications software, including the Cullinet Manufacturing System, are designed to use the IDMS/R relational data base. Like other manufacturing software product vendors, Cullinet has modularized its application packages in order to accomplish specific tasks or to work in conjunction with other software packages.

- Cullinet Manufacturing System, as the company's MRPII product is known, features eight individual modules including:

  - Bill of Materials.
  - Master Production Scheduling.
  - MRP.
  - Purchasing.
  - Inventory Control.
  - Cost Control.
  - Shop Floor Control.
  - Order Entry.

- Manufacturing modules are fully integrated with both Financial System modules (e.g., General Ledger, Accounts Payable, or Accounts Receivable), and Decision Support System (e.g., Goldengate PC Software and Trend-Spotter).

- Some of the manufacturing modules currently offered by competitions but not by Cullinet include shipping, sales analysis, financial statements, payroll, and service maintenance.

5. INTERNATIONAL BUSINESS MACHINES (IBM)

- IBM's Communications Oriented Production Information and Control System (COPICS) is an integrated groups of fourteen programs designed to support large discrete manufacturing organizations. COPICS programs run on IBM large system computers (4300 and larger) and use DOS/VS operating systems.

- One of the major advantages IBM has over other manufacturing software vendors is their ability to integrate hardware and software at the point of sale. Several manufacturing software competitions indicated that IBM controlled up to 50% of this software market as a direct result of their dominance of mainframe hardware sales.

- Price is another reason for COPICS popularity. While other vendors charge annual maintenance fees of $3,000 to $6,000 per module, IBM charges as little as $50 to $100 per month per module for leasing.

- IBM has kept COPICS prices low in order to promote hardware sales. Unlike their software-only competitors, IBM can distribute profitability over both hardware and software.

- Another reason COPICS prices can remain so competitive is due to the longevity of the package. When originally introduced the COPICS package supported just seven functions. IBM has successfully built on this base unlike

vendors such as Cullinet and MSA who were forced to spend million of dollars in order to acquire suitable packages.

- IBM has currently expanded the overall COPICS package to fourteen modules. These include:

  - Inventory Planning Forecasting.
  - Inventory Accounting.
  - Bill of Materials.
  - Customer Order Servicing.
  - MRP (Advanced Function).
  - Product Cost Calculations.
  - Order Routing.
  - Facilities Data Management.
  - Shop Order Release.
  - Plant Monitoring and Control.
  - Purchasing.
  - Receiving.
  - Shop Order Load Analysis.
  - Routing Data Control.

6. MANAGEMENT SCIENCE AMERICA

- MSA entered the manufacturing software market when they purchased ARISTA manufacturing Systems from Xerox in early 1982. Arista, now known simply as MSA's manufacturing System or MRP II, has been marginally profitable with just over 150 product installations.

- One of MSA's key competitive advantages, both in manufacturing and the overall software market, is name recognition. The company was founded in 1963 and, after near bankruptcy, has now grown to one of the largest independent software suppliers for microcomputers and mainframes. 1983 revenues were $139 million, a 43% gain over 1982 (1982 growth was 38% over 1981). Despite a poor first quarter, INPUT projects a 34% growth in 1984 to $185 million.

- In many ways MSA is similar to its nearest competition, Cullinet. Both companies acquired their manufacturing software packages from other vendors rather than developing them in-house. Both were well known software vendors before entering the manufacturing software market, and both MSA and Cullinet specialize in IBM software.

- The major difference between MSA and Cullinet is how they entered the applications market for manufacturing software. While Cullinet was originally a data base manufacturer that went into the applications business, MSA started as an applications software vendor that has recently joined with a data base manufacturer, ADR.

- The significance of the technology-sharing agreement between MSA and ADR lies in the fact that MSA can now provide what manufacturing software vendors say they want: a truly integrated manufacturing/financial/design package base on advanced DBMS products. MSA had worked with APR previously, but by sharing development technology, MSA hopes to take full advantage of APR/Datacom/DB features.

- MSA's Manufacturing System includes:
  - Historical Forecasting
  - Master Production Scheduling.
  - Manufacturing Standard.
  - MRP.
  - Simulation Requirement Planning.
  - Inventory Control.
  - Shop Floor Control.
  - Capacity Requirement Planning.
  - Procurement Management System.
  - Cost Management System.
  - Manufacturing Accounting System.
  - Order Processing System.
  - Product Costing System.
- In August 1984 MSA acquired Distribution Research Associates and with it the company's distribution software package. MSA chairman John Imlaz has indicated that this new program will be integrated into the manufacturing software package in 1985.

- MSA's two most widely used products are Human Resource (almost 3000 installation) and Financial Management (almost 1500 installations). MSA's Extended Closed Loop System will integrate business and manufacturing application products. Advantages of this integration include reduced implementation costs, elimination of manual interfaces, and elimination of information redunduncy.

7. MARTIN MARIETTA DATA SYSTEM

- Martin Marietta Data System (MMDS) was formed in 1970 and currently offers a wide variety of computer services including remote computing, professional services, turnkey system, and software products.

- Non-captive revenue growth for MMDS was 22% in 1983 (to $149 million) up from $122 million in 1982. Total revenue (including captive Martin Marietta revenue) was $279 million in 1983. Processing services represented 31% of 1983 non-captive revenues; International = 29%, Professional Services = 25%, Software = 13%, and other = 2%.

- Although software represents only a small portion of MMPS revenue ($19 million in 1983, with an annual growth of 42%), it is larger than several other vendors in this report, including Comserv and NCA. It should be noted, however, that MMDS' software revenue is derived from a number of products rather than just manufacturing software as with Conserv and NCA.

- MMDS offers a wide variety of software products which include:

  - Mainframe and minicomputer Application Software.

  - MAS--Manufacturing.

  - MAS--Personnel.

- MAS--Payroll.
- MAS--M (an integrated business software package)
- MAS-Project Management.
- MAS-Decision Support.
- Custom software to hotels, hospitals, banks etc.
- Systems Software.
  - . Ramis II.
  - . Atlas.
- Microcomputer Software.
  - . IT software--a package of 10 software modules.

- The Modular Application System (MAS)--manufacturing software, mentioned above, is one of MMDS's most successful products with over 700 installations (since 1973) around the world. The company claims that MAS-Manufacturing in "the leading selling manufacturing control system of all time".

- MAS-Manufacturing (along with the other integrated MAS products) are available in a wide variety of equipment: IBM mainframes (303X, 308X, and 43XX), DEC VAX, HP3000, and on Martin Marietta's own Remote Computing Service. MAS is available as a turnkey system, software only, or on a time-sharing basis.

- The six major modules for MAS-manufacturing are:
  - Master Production Scheduling.
    - Production Planning.
    - Scheduling.
    - Resource Requirements Planning.
  - Inventory Control.
    - MRP.
    - Inventory Maintenance/Management.
    - Inventory Accounting.
    - Order Management.
  - Manufacturing Control.
    - Product Scheduling.
    - Capacity Requirements Planning.
    - Shop Floor Control.
    - Performance Reporting.
  - Purchasing.
    - Requisitions.
    - Printed P.O.'s.

- Cost Control.
  - . Inventory Cost Comparison.
  - . W.I.P. Valuation.
  - . Material Variance Reports.
- Engineering Control.
  - . Product Structure Entry.
  - . Routing Data Entry.
  - . Process Maintenance.

- MMDS has stated that their MAS-manufacturing strategy is to develop a fully integrated computerized manufacturing system linking the current control systems with CAD/CAM systems, robotics, materials handling, and group technology. In addition, the company is attempting to improve the "transportability" of software so that the customers software investment is protected against future technological changes.

8. MCAUTO

- MCAUTO is unique in the manufacturing software business primarily because their background includes both manufacturing and software development. MCAUTO was established as a separate division of McDonnel Corporation 1960 in order to support the internal EDP requirements of that aerospace manufacturer. In 1968 the company began offering timesharing services.

- Within the manufacturing software market, MCAUTO feels that they must build on their stengths which they see as:

- Vast experience in the integration of IBM equipment with their own software.

- A strong background in discrete manufacturing.

- In-depth knowledge of design engineering and CAD/CAM.

- One telling remark from a MCAUTO company representative was "We would rather talk to it than do it," indicating MCAUTO's emphasis on integration of software and hardware rather than to compete with well established vendors inthe manufacturing software environment. This is the primary reason MCAUTO does not market a complete package of manufacturing software. The company does, however, offer a number of packages which apply to the manufacturing environment. These include:

  - Order and distribution system.
    - Order Processing (Co-op).
    - Order Processing Accounts Receivable (Co-op/AR).
    - MCAUTO Freight II.
  - Design System.
    - Computer aided design and drafting (CADD).
    - Unigraphics (CAE).
    - Fastdraw/3 (CAE).

- Manufacturing.
  - . UNIAPT (Numerical Control System).
  - . Compudrive (direct numerical control).
- Production planning.
  - . CAPOSS-E (shop floor scheduling, load leveling, etc.).
  - . OMEGA (order management system).
- Finance.
  - . Autocountant (general ledger, accoounts receivable, accounts payable, etc.).
  - . Autoplan (planning).
  - . FCS (Financial Consolidation System).
- Project Management.
  - . COPES (Cost Planning and Evaluation).
  - . MSCS (Scheduling and Control System).
  - . TMAPS/MAPS (Graphics).
  - . LISS (Material Tracking).

- Significant by omission is MCAUTO's lack of MRP, Bill of Materials, Purchasing, and Capacity Requirements Planning Software--all of which are

considered important MRP II packages. MCAUTO has indicated that they will probably not try to fill in the gaps in their manufacturing package but rather specialize in the following areas:

- Modeling, including CAD/CAM, design, and robotics applications.

- Analysis, involving Computer Aided Engineering (CAE).

- Manufacturing (limited), see above.

- Integration an Custom Development.

- Several MCAUTO respondents indicated that their primary emphasis would be in software/hardware integration where they felt they had the strongest competitive advantage. CIM, which MCAUTO defines as the integration of design, manufacturing, and financial data, is believed to be the key to both the industry's and MCAUTO's growth.

- In order to take full advantage the manufacturing industry's integration requirements, MCAUTO stressed that their software and integration techniques were desinged for "open architecture", i.e., software which could be used with a variety of different hardware and/or resident DBMS. In addition to open architecture, MCAUTO felt that demand for manufacturing software would center around:

  - A higher level of application sensitive machine automation.

  - Improved graphics.

  - Improved system communication and distributed networks.

9. NCA CORPORATION

- NCA Corporation was founded in 1969 and introduced their first manufacturing software package in the mid-1970s. The package, now known as MAXCIM, is the major contributor to the company's growth representing 58% of NCA's 1983 revenues. In addition, MAXCIM is one of NCA's fastest growing product, increasing 65% in 1983 to $10 million in total revenues. (The company's total revenue in 1983 was nearly $18 million, the remainder coming from the Design Automation Group and the Commercial Service Group.)

- Revenues in 1984 continues to increase at a rapid pace. Financial results for the first six months of 1984 show a 42% growth rate. Net income in1984, however, is down to 4.9% of total revenue from 6.1% in 1983. The desire to improve profits may have contributed to the decesion to lay off of 22 employees in July 1984, leaving a total of 270 employees currently employed by NCA.

- Like its primary competitor, Ask Computer, NCA offers its manufacturing software package as part of a turnkey system, as software along, or on an interactive timesharing basis. Currently, NCA has installed almost 400 MAXCIM products (120 VAX-based and 250 PDP-based system) along with 70 timesharing clients. Sales to VAX-based systems dominate current and future sales strategies.

- One distinct advantage NCA has over its competitors in the company's close working relationship with DEC. In November 1983 NCA entered into a cooperative marketing agreement with DEC which details extensive cooperation sales procedures between the two vendors. In addition, DEC market design software produced by NCA's Design Automation Group. NCA is also inthe process of enhancing the MAXCIM product in order to take advantage of the new VAX Information Architecture Performance Features.

- While the DEC-PDP-based software was originally designed for small manufacturing companies (less than 500 people and between $5 million and $50 million annual revenues), the current VAX-based MAXCIM product is designed for larger manufacturing companies with revenues of up to $300 million. Despite this historical commitment to DEC hardware, INPUT believes that NCA is evaluating manufacturing software opportunities, particularly with IBM hardware. The deciding factor will probably resolve around the ability to DEC-based products to generate continued revenue growth in the future.

- MAXCIM is a composite of over 20 program modules (and 600 individual software programs) which can be purchased separately or together. A complete software system for the VAX costs approximately $125,000 plus a maintenance fee of 10% of the purchased price per year.

- Modules are divided into four categories:

  - Manufacturing System.

    . This includes all of the standard MRP program such as Inventory, purchasing, Bill of Material, Work Order Status, Costing, Material Requirements Planning, Routing, and Scheduling.

  - Financial System.

    . Including order entry, invoicing, sales analysis, AR/AP/GL, and fixed assets.

  - General Application.

    . Industry Decision Support, Graphics, Documentation, and MAPS interface.

  - Data Management.

- The modules listed above are integrated in one central data base. The decision support packages is the latest module to be introduced, with modules on human resource and financial spreadsheet planning in the offing.

B. VENDOR STRATEGY IN THE MANUFACTURING SOFTWARE MARKET

- Although all of the vendors interviewed had a slightly different strategy for manufacturing software development, the foundation for each strategy was the same:

  - Vendors intend to stay primarily in manufacturing software--there does not appear to be any interest in adapting software products to other industry sectors;

  - All the vendors acknowledge the importance of CIM (Computer Integrated Manufacturing) but have little to show in the way of plans or products;

  - Most vendor's MRP products are well established--expansion generally involves increased design integration.

- Exhibit IV-1 summarizes product strategy.

- Expansion and/or development of CIM products is clearly the goal of all of the manufacturer interviewed by INPUT. CIM is generally defined as the integration of MRPI, MRPII, design automation (i.e., CAD/CAE) and manufacturing automation (process control, robotics, CAM).

- MCAUTO, heavily involved in integration technology as a result of the company's background in both CAD/CAM development and manufacturing software development, has identified three factors inhibiting growth of CIM:

EXHIBIT IV-1

VENDOR PRODUCT STRATEGY

VENDOR	STRATEGY
ASK	Extensive CIM development, CAD/CAM integration
Comserv	CIM development, increased cooperations agreements/acquisition to expand AMAPS. Currently working on CAP/CAM integration.
Cullinet	More emphasis on Process Manufacturing. Increased specialization in repetitive manufacturing and manuvacturing for government. CAD/CAM + CIM expansion.
IBM	N/C
MCAUTO	Increased specialization by industry (e.g., telecommunications, plastics). Extensive growth in design integration, LAN's, and open architecture design aspected.
MSA	Microcomputer software for manufacturing expansion. Growth in CIM, number of scheduling modules, and increased emphasis in process manufacturing.
NCA	Target larger accounts, increase CIM.

- Factors cannot afford the shut down time necessary for full automation conversion.

- Individual "Islands of Automation" are proving to have unique data processing requirements which are difficult to automate and even more difficult to integrate.

- Data Base Management Systems are not yet well developed enough to handle both graphics and text data.

- Although Comserv is considered a market leader in manufacturing software, the company does not have the financial resources of its large and more diversified competitors to develop CIM products. In order to remain competitive, Comserv has been actively trying to arrange a cooperative agreement with CAD/CAM vendors in order to develop CIM products. NCA, also a small vendor, has followed Comserv's example in this area.

- Larger vendors such as Ask, MSA, and Cullinet are using internal resources to integrate design packages with their current manufacturing software. All three companies are negotiating with CAD/CAM vendors, but would not elaborate on which products they plan to integreate.

- MCAUTO is unique in the CIM area because they are the only responding vendor to actually have both a CAD/CAM system and manufacturing software. The company is committed to the integration process; more so, perhaps, than the development of manufacturing software itself. (See the vendor profile for MCAUTO).

- Although CIM is the major long term strategic goal for the vendors interviewed, individual vendors had their own specific goals:

- NCA plans to target larger accounts as a result of the newly introduced VAX 11-785. The NCA respondent made it very clear, however, that the company plans to stay with DEC products only.

- MSA expects continued expansion in manufacturing software for microcomputers and greater involvement in process manufacturing.

- MCAUTO is developing a number of new application modules in scheduling and plan to increase vertical integration by industry.

- Cullinet is placing more emphasis on process manufacturing and repetitive manufacturing.

C. MANUFACTURING SOFTWARE MARKET CHARACTERISTICS

1. GROWTH

- All of the vendors interviewed by INPUT felt that the overall manufacturing software market was going to experience substantial growth through the end of the decade. Predictions ranged from an overall 20% AAGR (average annual growth rate) to over 50%.

- Exhibit IV-2 lists the reported growth characteristics of the manufacturing software market. As the exhibit demonstrates, vendor opinions on growth pattern vary widely. This is caused by several factors:

  - Some vendors, such as NCA, and MCAUTO have specialized in certain market segments and follow only those segments.

  - other vendors (MSA, for example) plan to specialize by industry segment and do not track overall growth in the manufacturing software market.

EXHIBIT IV-2

MANUFACTURING SOFTWARE GROWTH CHARACTERISTICS

VENDOR	CURRENT SIZE OF MARKET	CURRENT MARKET GROWTH RATE	VENDOR'S CURRENT MARKET SHARE	SIZE OF MARKET IN FIVE YEARS
Ask	N/C	N/C	N/C	N/C
Comserv	N/C	35%	30%	"Double"
Cullinet	N/C	50%	15%	N/C
IBM	N/C	N/C	N/C	N/C
MCAUTO	$1 Billion[7]	45%	N/C	$4-8 Billion
MSA	$100-200 Million[2]	N/C	15%	N/C
NCA[3]	N/C	50%	65%	$3 Billion by Year 2000

1 = Refers Primarily to Design Software Market

2 = Traditional Manufacturing Software Market

3 = All NCA Responses Refer to the Market for DEC-VAX Manufacturing Software

- Both IBM and Ask Computer said that growth statistcs were proprietary information and would not answer the questions.

- Despite the reluctance of most vendors to predict specific growth figures, all of the vendors were optimistic about future growth for manufacturing software. The MCAUTO respondent, for example, said that he was "extremely optimistic" about future growth and that "the trend (45-50% increase in sales) will not abate."

- One reason that vendors are so optimistic is that that potential for factory automation is so great. Comserv indicated that there has been only a 20% penetration by commercial vendors in the mainframe manufacturing software market. MSA indicated that software companies have penetrated even less of the microcomputer manufacturing software market (Microcomputer applications are discussed below).

- In addition to increased market penetration, growth in the manufacturing software market is being promoted by:

  - Growth in the use of manufacturing software in the process manufacturing sector (Comserv has a substantial competition advantage in process manufacturing as discussed in the Profile section, Chapter IV, A).

  - Changing structure of the manufacturing industry--companies are moving away from job shops to repetitive and scheduled shops--new technology which benefits from increased automation.

2. USER REQUIREMENTS AND PRICE SENSITIVITY

- Vendors are unanimous in their opinion that users are not price sensitive when it comes to the cost of manufacturing software as shown in IV-3. The vendors

EXHIBIT IV-3

MANUFACTURING SOFTWARE MARKET CHARACTERISTICS

VENDOR	MANUFACTURING SOFTWARE MARKET	
	USER REQUIREMENTS	USER PRICE SENSITIVITY
Ask	N/C	Users NOT Price Sensitive
Comserv	1. Just-in-Time (Application Software) 2. Zero Inventories (Application Software) 3. CIM	Users NOT Price Sensitive
Cullinet	1. Just-in-Time Software 2. On-Line Access	Users NOT Price Sensitive Payback in Quite
IBM	1. CAD/CAM Integration 2. More Accounting Software	N/C
MCAUTO	N/C	Users NOT Price Sensitive (PC Users may Resist Price Increase)
MSA	1. Process Control Software 2. CIM	Users NOT Price Sensitive
NCA	1. Repetitive Manufacturing 2. Just-in-Time Software 3. International Language and Currency Conversion	Users NOT Price Sensitive

reasoning is quite simple: the "payback" is so much higher (one vendor mentioned an 800% payback in two years) than the cost of the software that users rarely consider the price of software modules at all. Rather than cost, users typically concentrate on software performance and capabilities.

- As a consequence of the positive payback for manufacturing software and resulting lack of user price sensitivity, several vendors, including Comserv, Cullinet, and MCAUTO indicated that they may raise their software prices or at least maintain the current price. None of the vendors said that they had considered dropping the price of their software.

- Both MSA and MCAUTO said that they would expect much more user price sensitivity at the low end of the market--particularly with PC users. These vendors indicated that a different pricing and module design status would probably be necessary to successfully enter this market. Software for PCs is discussed in greater detail below.

- Exhibit IV-3 also lists current user requirements for manufacturing software. Most of the vendors interviewed remarketed that users were becoming more and more sophisticated in that they have analyzed their own changing requirements and have been proactive in suggesting additional modules to the vendor's software packages. The most common requirements were:

  - Fully integrated manufacturing packages.

  - Just-in-time inventory software.

  - Increased process control/on-line access.

  - Improved modules in accounting, inventories, and international conversion software modules.

- Vendors were divided as to why users were becoming more stringent in their marketing software requirements:

  - NCA attributed increasing user requirements to a series of user group meetings sponsored twice a year in which users are encouraged to support product improvements.

  - MSA feels that users are becoming more focused as their factories become more specialized and broad-based module solutions are no longer adequate.

  - IBM indicated that users are becoming less inclined to write their own software and now expect vendors to offer a wider variety of manufacturing software.

  - Cullinet, like MSA, feels that users are required more specialized software to meet the individuals particular need.

3. COMPETITION

- Competition in the mainframe and large minicomputer manufacturing software market is likely to increase according to vendors despite the fact that the actual number of competitors will probably fall as shown in Exhibit IV-4. The increased competition will be caused, in large part, by a growing market penetration by hardware manufacturers such as DEC, HP, and IBM.

- Competition is expected to remain intense at all levels of the manufacturing software market particularly among the major vendors. At the high-end, Ask is rumored to be preparing an IBM-compatible ManMan product while at the mid-level there is increasing emphasis on DEC products.

- MCAUTO feels that competitors will be forced to segment the market in order to remain successful, however, this is not the pattern developing

EXHIBIT IV-4

MANUFACTURING SOFTWARE MARKET - TRENDS IN COMPETITION

VENDOR	TRENDS IN COMPETITION	MAJOR COMPETITORS
ASK	N/C	Comserv , MMDS, NCA, Arthur Andrews, Rath and Strong
Comserv	Number of competitors will decline, but competition will remain intense as larger companies enter market	MMDS, ASK, Arthur Andersen, Cullinet, IBM MSA, Xerox
Cullinet	Number of competitors will decline, but hardware manufacturers will enter market	MSA, Xerox, Comserv, Arthur Andersen, IBM, MMDS
IBM	N/C	MSA, Xerox, Comserv, Cullinet, Arthur Andersen, MMDS
MCAUTO	Successful competitors will be forces to segment the market, rather than trying to serve all sectors	ASK, Comserv, NCA, IBM, MMDS, Cullinet
MSA	Traditional vendors will remain, increased compititives from hardware vendors, increased Japanese competition	Comserv, Cullinet, American Software, IBM, Arthur Andersen, MMDS, MSA, Rath and Strong, Xerox
NCA	Competition in DEC-VAX market will not be as intense as the rest of the manufacturing software market	ASK, Computer Covenant, Interactive Information System, MMDS, Xerox

today. Several of the most successful vendors (Ask and MMDS, for example) have been very successful by identifying high growth systems (such as DEC-VAX) and topping into that market. Most other vendors have focused in on the IBM-compatible market. Only NCA has indicated that they will remain as non-IBM, one-system vendor. (NCA specializes in DEC-VAX software.)

- The second major competitive trend vendors see developing is an overall decline in the total number of large system manufacturing software vendors. This decline is expected to come at the expanse of smaller vendors and will be caused by several factors:

  - Smaller vendors will be forced to drop out of the market as they find it more and more difficult to develop CIM packages in corporation with CAD/CAM vendors, who, in many cases, will have already established agreements with larger manufacturing software vendors.

- It will be very difficult for small vendors to allocate the R&D funds necessary to develop products to meet user expectations for add-on modules and support services.

- As larger companies enter the lucrative manufacturing software market, it is expected that some will follow the Cullinet and MSA example and acquire an existing software package rather than develop their own in-house product.

- The larger vendors currently in the market (including all of the vendors in the study) are expected to remain market leaders on the strength of their well developed products and substantial installed base. However, these vendors do have weaknesses, as shown in Exhibit IV-5.

  - Comserv's main strength lies in the quality of the AMAPS product. Competitors acknowledged Comserv's market leader status and their sales staff, particularly when selling to MIS managers. Comserv's weaknesses--delineated by competitors Cullinet and MSA--delt pri-

EXHIBIT IV-5

MANUFACTURING SOFTWARE MARKET
COMPETITIVE STRENGTHS AND WEAKNESSES

COMPETITOR	STRENGTHS/WEAKNESSES	CITED BY WHICH VENDORS
American Software	Strengths:	
	1. Very Good in Marketing	MSA
	Weaknesses:	
	1. Limited Experience in CIM	MSA
Ask	Strengths:	
	1. Name Recognition	NCA
	2. Strong Financials	NCA
	3. Well Developed Sales Strategy	Comserv
	4. Large User Base	
	Weaknesses:	
	1. Defocused (Multiple Strategies)	NCA
	2. Opportunister	NCA
	3. Short-Term Commitment to Market	NCA
	4. Primarily H-Puriented	NCA
	5. 1960s Timesharing Technology	Comserv
	6. Relations with Hewlett-Packard are Deteriorating	Comserv
	7. Over-Commiting Themselves by Entering Mainframe Market	Comserv
Comserv	Strengths:	
	1. They are "Known Experts", Market Leaders	MSA, Cullinet
	2. Sell will to MIS Manager and Lower	MSA
	Weaknesses:	
	1. Poor Financial Condition	Cullinet
	2. Has had Trouble Getting Products Out On Time	Cullinet
	3. Too Focused, Not Enough Products	MSA
	4. Have Difficulty Selling to Vice-President and Above	MSA

EXHIBIT IV-5 (Cont.)

MANUFACTURING SOFTWARE MARKET
COMPETITIVE STRENGTHS AND WEAKNESSES

COMPETITOR	STRENGTHS/WEAKNESSES	CITED BY WHICH VENDOR
Cullinet	Strengths:	
	1. Sell Effectively to DP and MIS Managers	MSA, Comserv
	2. Has Broad Appeal (Numerous Products)	MSA
	3. Good at Selling "Vaporware, i.e., Software which is not Yet Developed	Comserv
	Weaknesses:	
	1. Locked Out of the IBM EBMS Market	Comserv
	2. Too Many Products/Spreading Themselves Too Thin	Comserv
	3. Inadequate User Support	Comserv
	4. Experienced Difficulty Implementing Products on Time	MSA
MSA	Strengths:	
	1. Sensitive and Knowledgable About Market	Cullinet
	2. Large Company with Many Resources	Cullinet, Comserv
	3. Large User Base	Comserv
	4. Excellent Sales Force	Comserv
	Weaknesses:	
	1. Products Based on Old Technology	Comserv
	2. Inadequate Integration of Broad Product Line	Comserv
	3. Not Strong an conversion/Iqntegration of Hardware and Systems Software	Cullinet
Xerox	Strengths:	
	1. Excellent Integration of DBMS with Applications Software	Cullinet
	Weaknesses:	
	1. Limited Experience in Manufacturing Environment	Cullinet

marily with the administration of the product and the company. The poor financial condition, new product development and inability to sell at the corporate (as opposed to MIS) level were mentioned.

- Unlike Comserv, Ask Computer's ManMan product was criticized, but the administration of the company was praised by competiors. Typical comments were that the company had an excellent marketing group and sales staff but that the product was based on 1960s technology and was too oriented toward Hewlett-Packard products. Two of Ask's direct competitors, Comserv (in the HP line) and NCA (in the VAX line) felt that Ask was commiting its ManMan product (with limited capabilities) to too many markets.

- Cullinet's primary strengths derived from the company's reputation is the software industry as a whole, not from their participation in the manufacturing software market. Their sales staff was complimented by competitors as well as the company's broad product offerings. Cullinet's weaknesses were centered around the company's DBMS packages and their inability to support application products adequately. In addition, both MSA and Comserv indicated that Cullinet had problems with the timely introduction of software.

- Significantly, none of the vendors interviewed mentioned IBM as a competitors. This is suprising because all of the vendors except Ask and NCA compete directly with IBM in the manufacturing software market. One reason for this omission may be that IBM sells their software along with hardware almost as a turnkey system and that the software is very inexpensive. Other vendors may feel that they are not, in fact, competitors of IBM for this first time buyer. MSA did indicate that they focused on IBM COPICS customers that had "outgrown" their software.

- MSA, like Cullinet, was respected by competitors not for their manufacturing software, but for the company's organization and many resources. The company's background in the software market and excellent sales force were mentioned as particularly strong assets. MSA's weaknesses revolved around their manufacturing software product; it is based on "old technology", it is not properly integrated with other application products, and the company is not strong on user support for data conversion.

- NCA's strengths and weaknesses were not evaluated because their only competitor among the interviewers (Ask Computer) did not respond to question 8. Secondary sources, however, reveal that one of NCA's real strengths is the company's close working relationship with DEC. The two companies work closely together and have signed a number of cooperative agreements. A potential weakness at NCA is he company's dedication to DEC equipment. Currently, DEC's expansion of the VAX line provides NCA withan excellent high growth market, but as competition for VAX software increases (note the entry of Ask and MMDS in the VAX market) NCA may find this market too restrictive.

- Like NCA, MCAUTO was not cited as a competitor by any of the vendors interviewed by INPUT. This is not suprising because MCAUTO does not feel they are competing in this market rather, they are supplementing products currently available from other vendors. MCAUTO said that they believe their major strengths are in design software products and products to facilitate integration of manufacturing software with design software. The fact that MCAUTO's manufacturing software is incomplete (the company doesn't offer an MRP product, for example) may be seen as a strategic weakness.

- Overall, the vendors interviewed by INPUT agreed that while the number of manufacturing software vendors would decline, competition would be more fierce because the remaining companies would be larger and stronger.

Competition analysis of Comserv emphasized the high growth of the AMAPS product but criticized Comserv administration for their failure to capitalize on the company's product.

D. TRANSITION PRODUCTS

1. MRP AND FACTORY DATA CONVERSION

- While all the vendors interviewed by INPUT acknowledged the importance of converting data from first generation manufacturing software to more current MRP II type products, very few have any tangible transition product to offer clients. The prevailing attitude among vendors seems to be "My company is not responsible for data collected under another software package, but we will help transfer that old data to our system--on an informal basis."

- Most of the vendors limit conversion assistance to pre-installation training and education, as shown in Exhibit IV-6. A few companies actually have data conversion, while others offer a variety of individualized consulting services to assist in the transition period.

- Comserv has one of the best training and education programs (which earns about 15% of the company's total revenue), but this is of limited use in the transition process. MSA has developed an impressive "Implementation Methodology" to assist the user in planning for conversion with the understanding that the user must arrange for the actual conversion.

- Ask and to a lesser extent, Cullinet offer conversion programs to assist users in transfering data. Ask has an internally developed product designed to "load" data from one software package into another. The Cullinet program, called Escape, allows users to emulate their old MRP software with the more recent Cullinet product. While "Escape" does not actually transfer or convert

EXHIBIT IV-6

VENDOR METHODOLOGIES IN MRP AND FACTORY FLOOR DATA CONVERSION

VENDOR	TRANSITION PRODUCT/PROCEDURE
ASK	ASK will work with customer to apply standard "load" programs to convert data. Respondent sail conversion can be made from "any" MRP programs and most factory floor program.
Comserv	Transition assistance limited to pre-product training and education.
Cullinet	"Escape" is offered to customers who want to emulate their old MRP product. Cullinet does not offer any product to assist in actual conversion of data.
IBM	Will assist the user in transition with the understanding that the actual conversion process is the user's responsibility.
MCAUTO	MCAUTO has established an "Integration and Customer Development Group" to assist users in the transition process. This group has already written numerous transition programs and will write custom programs if needed.
MSA	Has developed an "Implementation Methodology" document to plan for the conversion. MSA will provide some consulting assistance, but the customer must do the actual conversion.
NCA	Offers extensive pre-conversion training. NCA has recently acquired a consulting company (The Systems's Practice), to assist users in the transition process.

data, it does permit a longer transition period during which the user can get used to the new system.

- MCAUTO and NCA have taken a different approach in assisting the use in the transition process--they have set up custom consulting groups that work with the users to develop actual conversion procedures. MCAUTO indicated that, if the user wishes it, data can be transferred via MCAUTO timesharing services. NCA has only recently established its consulting group--they acquired a consulting house, called the System Practice, which specialized in NCA conversions.

- The custom consulting may prove to be the most effective long term approach in the transition from an MRP or factory floor product to an MRP II or CIM group of products. MCAUTO pointed out that the overall transition process is being inhibited by the fact that individual "Islands of Automation" are proving to have unique data processing requirements and users expect the vendor to customize the MRP II or CIM package to meet those requirements. Vendors who do not supply this individualized service, according to MCAUTO and NCA, will find it more and more difficult to expand as the percentage of automated shops increases.

2. CAD/CAM DATA CONVERSION

- As with MRP and Factory Floor data conversion, all of the vendors interviewed acknowledged the importance of the integration of CAD/CAM data into their manufacturing software package. If anything, CAD/CAM transition products were considered more important than other conversion aids because design software is at the heart of any CIM package.

- Although manufacturing software vendors acknowledges the importance of CAD/CAM integration, significant problems with the integration process were reported:

- The decision as to which CAD/CAM vendor to work with in the development of integration products.

- The capability of the DBMS software to handle both manufacturing and design data.

- How to integrate previously stored design data.

- Exhibit IV-7 demonstrates that only two of the seven vendors interviewed currently offer CAD/CAM integration products, and only one vendor (MCAUTO) can offer a truly integrated package. (NCA's integration is done on a custom basis).

- MCAUTO has a competitive advantage in CAD/CAM data integration because of the company's strong combined background in aeronautical design, CAD/CAM development, and manufacturing. But even with this strong background, MCAUTO reported that a major goal of their Computer Integrated Manufacturing Technology Division (CIMTEK) was to improve the synthesis of graphics and manufacturing data.

- NCA handles CAD/CAM data conversion in much the same way as MRP or Factory Floor data conversion, the company has a "Design Automation Group" that works with the users, on a custom basis, to perfect the integration process. The advantage of this approach is that almost any CAD/CAM system can be integrated into an NCA software package and there is a high level of user satisfaction. Disadvantages are that the custom work can be time-consuming (consequently, not acceptable for a large user base) and very costly.

- All of the other vendors interviewed (including Comserv) are in the planning process. Comserv and Cullinet are negotiating with specific CAD/CAM vendors (they would not name the vendors) to develop an interface between the vendor's CAD/CAM system and their own software. Ask and MSA would only say that they were planning for CAD/CAM integration.

EXHIBIT IV-7

CAD/CAM DATA CONVERSION

VENDOR	CAD/CAM TRANSITION PRODUCT
ASK	No CAD/CAM interface at this time, planning in progress
Comserv	No CAD/CAM interface at this time, negociations under way with CAD/CAM vendor to offer design capabilities
Cullinet	No CAD/CAM interface at this time, negociations under way with CAD/CAM vendor to offer design capabilities
IBM	No CAD/CAM interface at this time
MCAUTO	Yes, integration available with MCAUTO's Unigraphic design / CAD/CAM system
MSA	No CAD/CAM integration at this time, planning in progress
NCA	Yes, integration possible, on a custom development basis, with CALMA, Apphian CAD/CAM equipment

- It seems likely that all of the larger vendors will eventually form cooperative agreements with one or more CAD/CAM vendors in order to develop adequate CIM packages. The actual conversion process will depend--to a large extent--on the future development of data base management systems and/or telecommunication/network packages.

E. HARDWARE AND SYSTEMS SOFTWARE REQUIREMENTS

- Hardware and system software requirements for the major manufacturing software vendors are listed in Exhibit IV-8. Conclusions drawn from this Exhibit include:

  - Most (78%) of the major manufacturing software vendors sell to the IBM mainframe market.

  - Fifty-six percent of the vendors listed in Exhibit IV-9 sell software for two or more manufacturers hardware.

  - Forty-four percent of the vendors sell software for DEC-VAX systems, and 33% sell to the HP-3000 market.

  - Seventy-eight percent of the manufacturing software vendors listed in Exhibit IV-9 have written their software in COBOL.

EXHIBIT IV-8

MANUFACTURING SOFTWARE SYSTEM REQUIREMENTS

VENDOR	PRODUCT	HARDWARE	SYSTEMS SOFTWARE	SOURCE CODE
Comserv	AMAPS	IBM 370, 30XX, 43XX	DOS, DOS/VS	COBOL
	AMAPS/3000	HP 3000	MPE	COBOL
Ask	ManMan	HP 3000 DEC VAX	MPE UMS	Fortran
Arthur Andersen	MAC-PAC	IBM 360/370 30XX, 43XX	DOS/OS	COBOL
		HP 3000	MPE	COBOL
Cullinet	Cullinet Manufacturing System	IBM 360/370 30XX,43XX	OS,DOS UM,VS,VSW MUS/XA	COBOL
IBM	COPOCS	IBM 370, 30XX,43XX	DOS/VS	COBOL
MMDS	MAS-Manufacturing	IBM 303X,308X. 43XX	DOS,VSE	COBOL
		DEC VAX	UMS	COBOL
MSA	MRPII	IBM 360/370 30XX,43XX	OS DOS	COBOL
MCAUTO	COPES MAPS	IBM 360/370 30XX, 43XX DEL VAX	MVS,VMS	COBOL
NCA	MAXCIM	DEC PDP-11 VAX	RSTS VMS	Basic

EXHIBIT IV-9

PERSONAL COMPUTER/WORKSTATION INTEGRATION

VENDOR	PLAN TO USE PCs		PLAN TO USE WORKSTATIONS	
	YES/NO	OPERATING SYSTEM	YES/NO	OPERATING SYSTEM
Ask	Yes	MS-DOS	Yes	N/C
Comserv	Yes	MS-DOS	Yes	N/C
Cullinet	Yes	N/C	Yes	N/C
IBM	Yes	DOS/OS/MVS	N/C	N/C
MCAUTO	Yes	N/C	Yes	N/C
MSA	Yes	MS-DOS	No	-
NCA	Yes	MS-DOS	Yes	N/C

F. IMPACT OF MICRO-BASED SYSTEM ON THE MANUFACTURING SOFTWARE MARKET

1. INTEGRATION OF PERSONAL COMPUTERS AND WORKSTATION

- Although all of the vendors interviewed by INPUT plan to use personal computers with their software systems (as demonstrated by Exhibit IV-9), only two vendors (Ask and NCA) report they are currently using PCs with their systems. Most vendors are taking a "wait and see" attitude about PC integration to determine if there is, in fact, user demand for this hardware feature.

- In addition to market considerations, several vendors expressed concerns about data contamination if users are allowed to modify data at the PC level--which may or may not have the benefits of error checking programs normally resident in the central MRP II software module. It is for this reason that both Ask and NCA limit PC integration to off-the-shelf planning programs like Lotus 1-2-3 (NCA) and VisiCalc (Ask).

- Except for IBM (who intends to use PCs as dumb terminals) most of the vendors said that they intend to use the MS-DOS operating on PCs integrated into their software systems. This popular operating system was chosen because of its flexibility, compatibility with major hardware products, and versatility with application software.

- Vendors are much more undecided about the use of integrated workstations than they were about PCs. Although five of the seven vendors said they planned to use engineering workstations, not one had actually selected a model to use, and none would even hazard a guess as to the operating system their future engineering workstation might use.

- The main cause for indecision regarding workstations is that most vendors are still undecided as to a CAD/CAM system to use. Workstations will not be

chosen until the CAD/CAM application is in place. However, all the vendors (except MSA and IBM) felt that once a CAD/CAM product had been integrated, engineering workstations would be used extensively.

2. MICRO-BASED DISTRIBUTED PROCESSING

- There was no concensus among the vendors regarding the role of micro-based distributed system such as the new IBM PC-AT. Some vendors felt it would be a valued edition to their overall system, others felt it would help them access new markets, while some vendors questioned the usefulness of the PC-AT at all or said it was too early to tell if the PC-AT could be effectively applied to this market.

- Most vendors (including Ask, Comserv, MCAUTO, and MSA) felt that a distributed PC netowrk would be useful because it would increase the efficiency of the overall system. Users/departments could download only the information the needed work on the data as necessary and then upload the result, all without overloading the central system. In addition, it will be possible to share data within departments--again, increasing the efficiency of the system.

- Exhibit IV-10 demonstrates MSA's interpretation of how a distributed PC system might increase efficiency. Users at the departmental level could coordinate day-to-day activities nice messages to distributed PCs. Data would be collected and compiled, and ultimately uploaded to the plant mainframe. The distributed system, according to MSA, provides the following benefits:

  - Real-time updates (at departmental level).

  - On-line control (at departmental level).

  - Reduced control system degradation.

EXHIBIT IV-10

MANUFACTURING SOFTWARE APPLICATIONS

LOCATION	HARDWARE REQUIREMENTS	MANUFACTURING SOFTWARE APPLICATIONS
Multi-Plant Administration	Large-Scale Mainframe e.s. IBM 3083	Complete CIM Package Including: 1. Modeling/Design (CAD/CAM) 2. Analysis (CAE) 3. Manufacturing (MRPII) 4. Integration
Individual Factory	Mid-Range, Front End Processor e.s. IBM 4300	Most MRPII Functions Including: 1. Scheduling 2. Inventory Control 3. Manufacturing 4. Purchasers 5. Financial 6. Cost Control 7. Engineering Control
Department within Factory	Distributed Processing System e.s. IBM PC AT	Selected MRPII Functions Depending on Departmented Requirements, e.g., 1. Inventory Control - MRP - Inventory Maintenance - Inventory Accounting - Order Management
Workstation within Department	Personal Computer e.s. IBM-PC	Single Application Workstation: 1. Data Collection 2. Rudimentary Planning/Scheduling

- MSA also mentioned that micro-based distributed data processing would be particularly useful because it provides a potential hardware/software package to users who do not need a full MRP II system. The distributed PC system could be used to run just a few MRP modules such as production planning, scheduling, etc. MSA noted that there are numerous small manufacturers who need selected manufacturing software packages, but have neither the money nor the need for a full MRP II package. The distributed PC not only serves this market, but also acts as an entry level system which ties the manufacturer into the vendor's software.

- NCA reported the one reservation with distributed PC-based system--that data would be contaminated at the departmental level. NCA also pointed out that distributed PCs offer little, if any, cost savings when compared to on-line terminals. A much better system, according to NCA, would be to use PCs as batch-mode intelligent terminals. Data from these terminals could be verified at the end of each day and the central database updated. NCA acknowledges that this type of batch-made updating reduces the on-line/real-time effectiveness of the system.

V USER ANALYSIS

V USER ANALYSIS

A. DECISION-MAKING PROCESS

- Integrated manufacturing software users experience with their software ranged from an average of 19.3 months (Cullinet-CMS users) to an average of 36 months (MSA MRP II users). Comserv users surveyed averaged near the lower end of the range, averaging 14 months experience with their software.

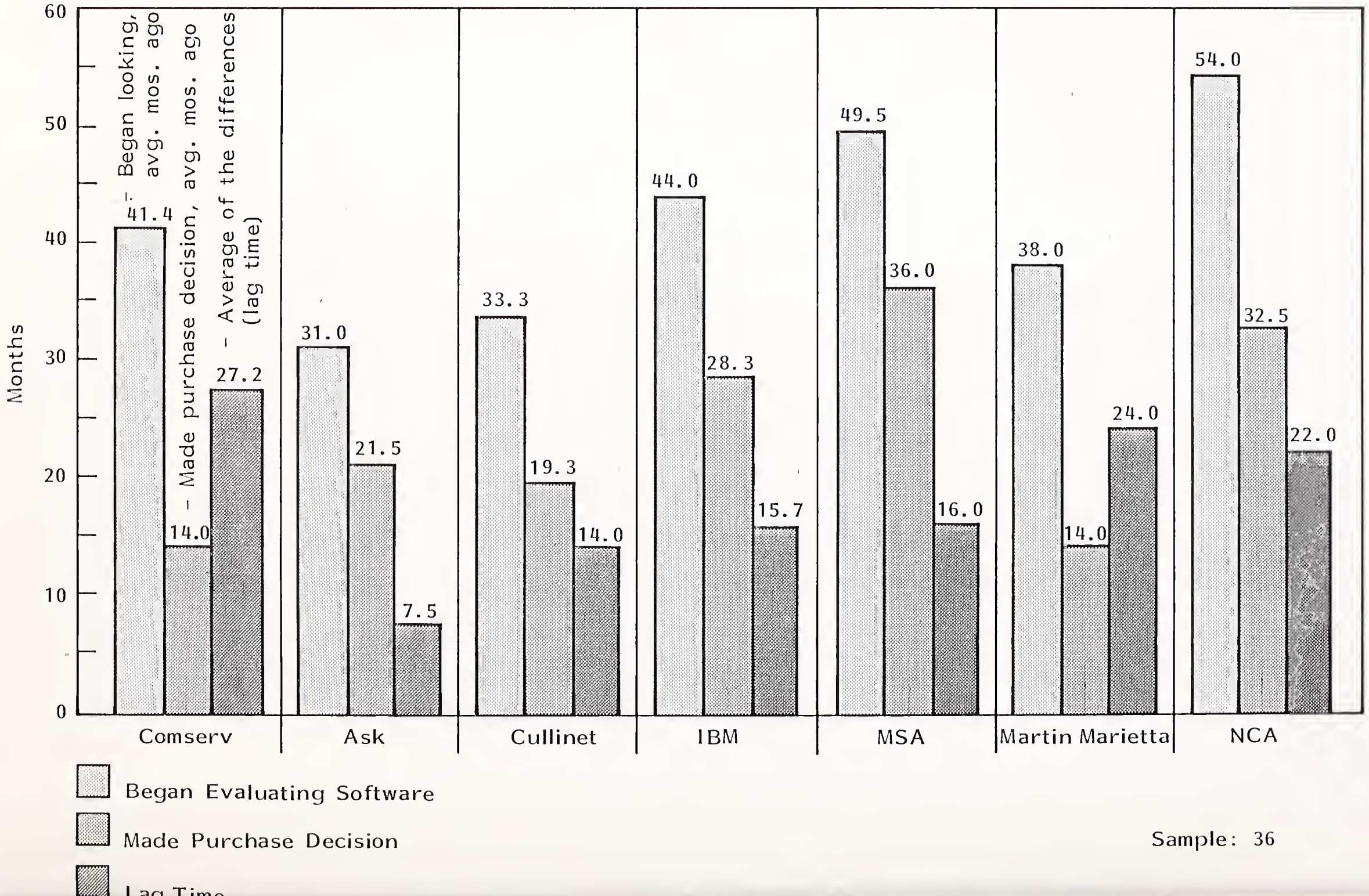
- Of greater importance is the lag time between the time the users begins to look at integrated software and the time he selects and purchases software. Most users reported that between 12 and 24 months elapsed between the time they began reviewing software packages, until the time they make their decision. Comserv users, for example, average 27 months lag time, as shown in Exhibit V-1.

- Principal motivating factors for looking at integrated manufacturing software were the desire to integrate their manufacturing and financial functions, relieve inventory imbalances, gain control of their manufacturing activities, and improve overall productivity. Potential inventory reduction was most often the parameter used in pre-purchase cost-justification analysis.

- Usually present in the decision-making process were management level representatives from inventory control, manufacturing, MIS, and finance groups within the corporation. In most large corporations, the purchase decision starts within a large (6 to 12 person) committee, in which the project manager

EXHIBIT V-1

PURCHASE DECISION LAG TIME BY VENDOR



Sample: 36

makes an initial recommendation; however, the weight of authority usually stayed with a smaller group made up of MIS, finance, and manufacturing upper management. In smaller companies, the weight of authority was often split between president, executive vice president, and controller.

- In the majority of the corporations surveyed, the financial stability of the software vendor was a consideration. This consideration became a factor at the early stages of the decision-making process, as most users eliminated some smaller vendors (such as Rath and Strong) due to their size. In most cases, however, the users looked at the quality and completeness of the software and support available as a decision-factor. Even though most users surveyed were making their decision before Comserv's financial difficulties, most Comserv uses felt that they would still choose Comserv as their software vendor, due to the quality of the product and the vendors extensive user base. It is significant that most Comserv users surveyed seemed aware of Comserv's financial situation, yet still reconfirmed the correctness of their decision.

B. USER SATISFACTION WITH INSTALLED PRODUCT

- User satisfaction with their integrated manufacturing software is relatively high. Almost all users reported that the software met their initial expectations. Only two users (one Comserv user, one NCA user) complained of bugs within the program, and one other user (an MSA user) had problems with early stage customization necessary at his installation.

- The overall satisfaction with their software is again supported by Exhibit V-2, which indicates that in almost all areas users receive satisfactory support. The one exception is in the area of customization, which is a sensitive area as the software is "fine-tuned" to fit the users actual need.

EXHIBIT V-2

USER RATINGS OF VENDOR SUPPORT

VENDOR	TRAINING	DOCUMENTATION	SOFTWARE MAINTENANCE	PRODUCT DEVELOPMENT	CUSTOMIZATION	MODULES AVAILABLE	QUALITY OF SUPPORT
Cullinet	8.0	(9.0)	(9.0)	(9.0)	[7.0]	8.0	8.0
ASK Computer	7.0	7.0	8.0	(8.5)	[6.5]	(8.5)	8.0
MSA	(8.3)	7.8	7.3	8.0	7.3	[6.5]	7.6
Comserv	7.5	7.9	7.2	7.5	[5.7]	7.9	(8.0)
NCA	7.7	7.3	7.3	7.3	[5.7]	(8.3)	7.7
IBM	6.3	(8.3)	8.0	6.7	[4.0]	7.0	8.0
Martin Marietta	6.7	5.7	[4.0]	6.3	5.5	(8.7)	5.3

Scale: 1 = Low, 10 = High

□ = Lowest
○ = Highest
} For Each Company

Sample: 35 Users

C. USER ANALYSIS OF COMSERV

- Comserv users reported that they took the greatest amount of time between initially evaluating software and making the purchase decision as illustrated in Exhibit V-3. During this time period over one-half of the respondents analyzed the software through an established cost justification analysis process. During this testing, the users attempted to show a potential inventory reduction and labor (manpower) savings.

- Also during this evaluation time, users look into the background of the vendors that they considered. Most users surveyed felt that the vendors' background in manufacturing was a major criteria in evaluating their software. Comserv users were impressed with the understanding of manufacturing needs and processes in their evaluation of Comserv.

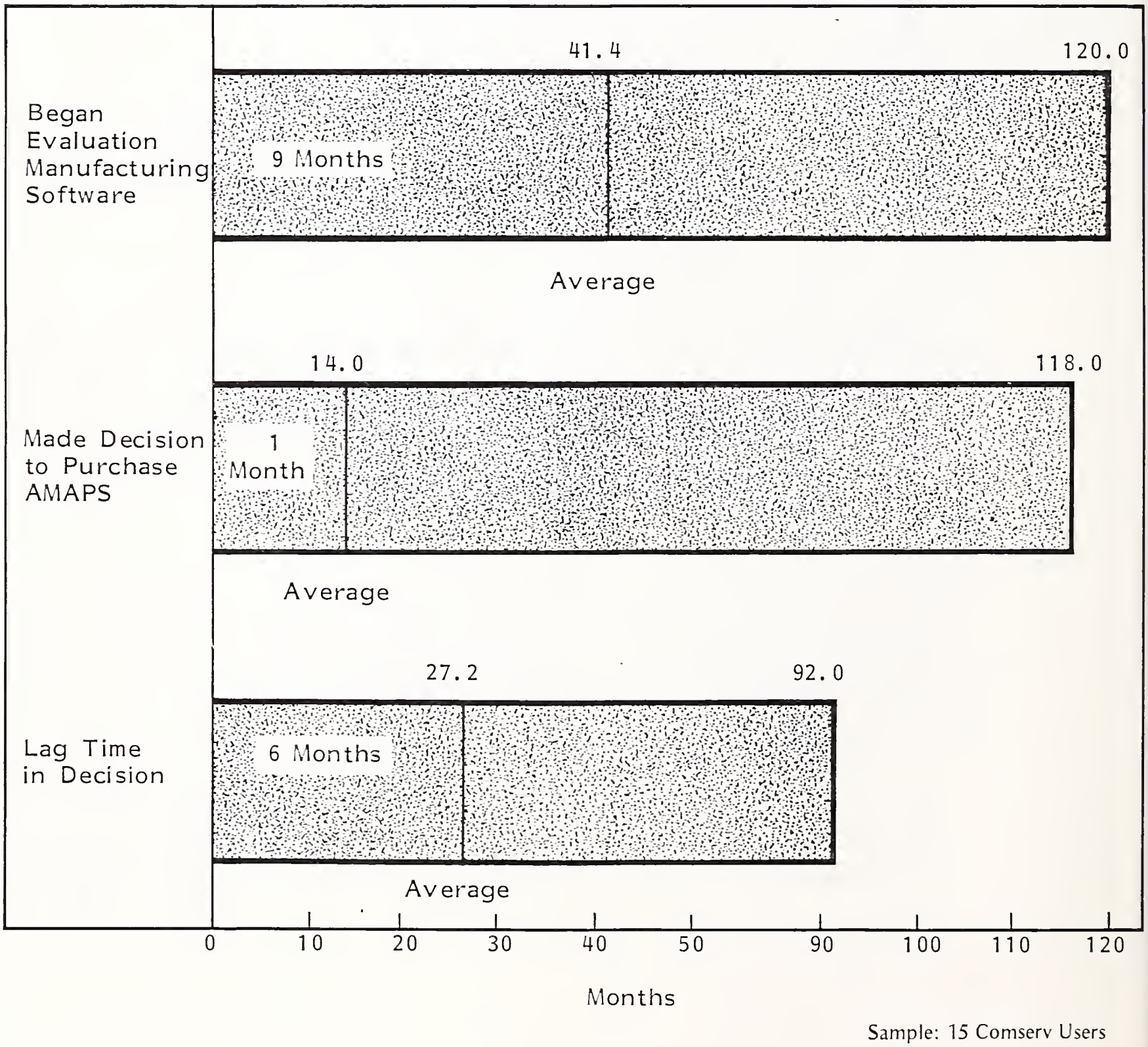
- Another important consideration these users indicated during their evaluation process was the financial stability of vendor being considered. Most users indicated that they looked into the financial stability of vendors, but at the time of purchase, all six vendors appear to be very stable. Smaller vendors, such as Rath and Strong, were eliminated at the initial evaluation stage due to their small size.

- Most of the Comserv users surveyed seemed to be aware of Comserv's current financial situation. In almost all cases, however, the users felt that due to Comser's quality product and large user base that their purchase decision was correct and that their investment was safe.

- The initial evaluation of manufacturing software is handled by a large (six to twelve person) group made up of representatives from manufacturing, finance, and MIS. The actual decision-making power is narrowed to a much smaller group of people, usually three to six people in size, representing manufacturing, MIS and finance.

EXHIBIT V-3

COMSERV AMAPS SOFTWARE USER DECISION TIME
(IN MONTHS)



Sample: 15 Comserv Users

- Exhibit V-4 provides a glimpse into the decision making power group for Comserv users. Most often involved were vice president or director level representatives from manufacturing and MIS. Yet in the actual power of decision, the greatest authority is held by the vice president (or director) of manufacturing, the project manager (who actually has most to gain from the implementation of MRP-type software), and the vice president of finance (Who has control over budget). The MIS director, while frequently present in the decision-making process, has comparatively little authority in the final decision.

- The Comserv users chose AMAPS over competitive products from a number of vendors, most frequently MSA's MRP II (at that time, marketed by Xerox as Arista), with, six mentions, Martin Marietta's manufacturing software, with five mentions, and IBM COPICS and Hewlett-Packard's manufacturing software, with four mentions apiece.

- Cullinet's CMS manufacturing software, now considered a major competitor to Comserv, received only two mentions, due to the fact that most of the user's surveyed made their purchase decision at a time when Cullinet product was too new.

- Comserv users were drawn to the integration and financial completeness of the package. Principle motivating factor most often reported by Comserv users was the desire for complete control and integration of their financial and manufacturing processes. Their reasoning for choosing Comserv's AMAPS (or AMAPS 3000 for HP system users) was most often the completeness and functionality of the program.

- An additional "selling" factor of the Comserv product was an often neglected service provided to software users--software support. Five of the fifteen users surveyed listed software support, training and education as the reason why they chose AMAPS.

EXHIBIT V-4

WHO PARTICIPATES IN SOFTWARE PURCHASE DECISION COMSERV USERS

TITLE	NUMBER OF DISTINCT MENTIONS	TOTAL WEIGHT OF AUTHORITY	AVERAGE WEIGHT OF AUTHORITY*
Vice-President or Director of Manufacturing	8	34	4.3
Vice-President of MIS	8	28	3.5
Vice-President of Finance or Controller	6	23	3.8
Project Manager	4	16	4.0
President or CEO	3	8	2.7

* Rating: 1 = Low, 5 = High

- The importance of AMAPS' comprehensiveness shows up in the reasons given for not choosing competitive products, especially in users who considered IBM COPICS and HP's manufacturing software programs. These users were attracted to the completeness of AMAPS core program, which included modules such as Bill of Materials, Material, Control System, Shop Floor Control, Material, Resources Planning, Standard Costs system, and Master Production Systems. These users planned to, or were already in the process of adding other modules, such as the Cost Management System.

- As previously stated, Comserv users emphasize the importance of post-sales support. Of the fifteen AMAPS users surveyed, thirteen users purchased additional training support, for an average of $67,000 (each user), and twelve users purchased vendor-supplied software maintenance, for an average of $23,000 per year. Additional Comserv user expenditures for post sales support are presented in Exhibit V-5.

- Comserv users reported overall satisfaction with the support that they received from their vendor. As shown in Exhibits V-6 and V-7, Comserv received higher ratings than its competitors as a group in five of the seven areas tested, training, documentation, continuing product development, and modules available. Only in software maintenance and customization do Comserv users rate their vendor lower than the competitors users. Customization is considered such a weakness that none of the fifteen Comserv rated the other 5.7. None of the 25 Comserv users surveyed purchased additional customization from the vendor, indicating that Comserv's customization offering is either weak or nonexistent, or that whatever customization is available is very difficult to implement. This could prove a problem to potential users who desire a better coordination with a particular manufacturing process need. It should be pointed out that the competitors users also gave their vendors poor marks in customization.

EXHIBIT V-5

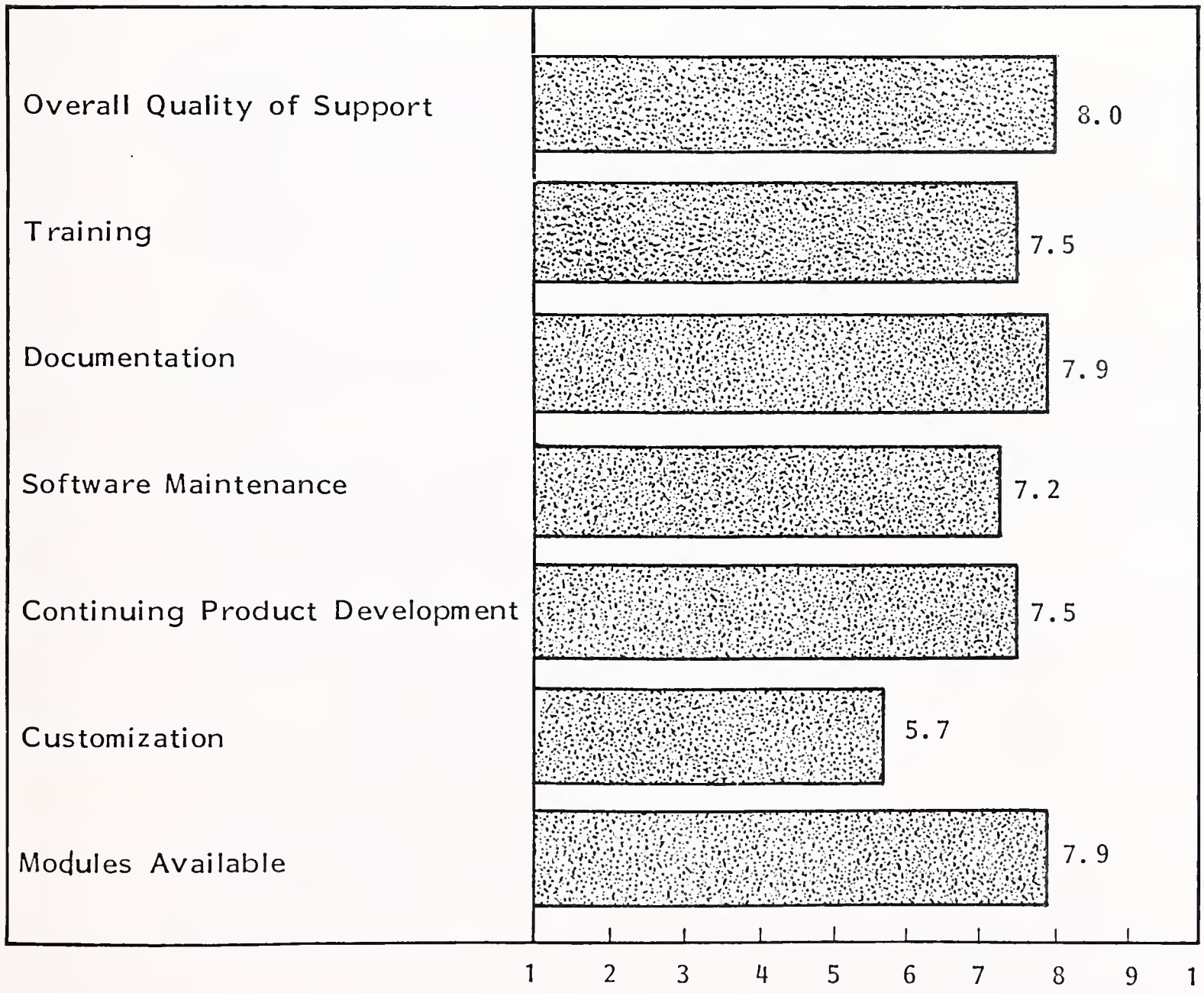
ADDITIONAL COMSERV USER EXPENDITURES
FOR POST SALES SUPPORT

ADDITIONAL SUPPORT ITEM	NUMBER OF YES RESPONSES	NUMBER WHO DIVULGED DOLLAR VALUE	AVERAGE DOLLAR VALUE
Support	4	4	$57,500
Training	13	8	67,750
Documentation	4	3	1,833
Software Maintenance	12	7	22,714
Customization	0	0	-

User Sample = 25 Users

EXHIBIT V-6

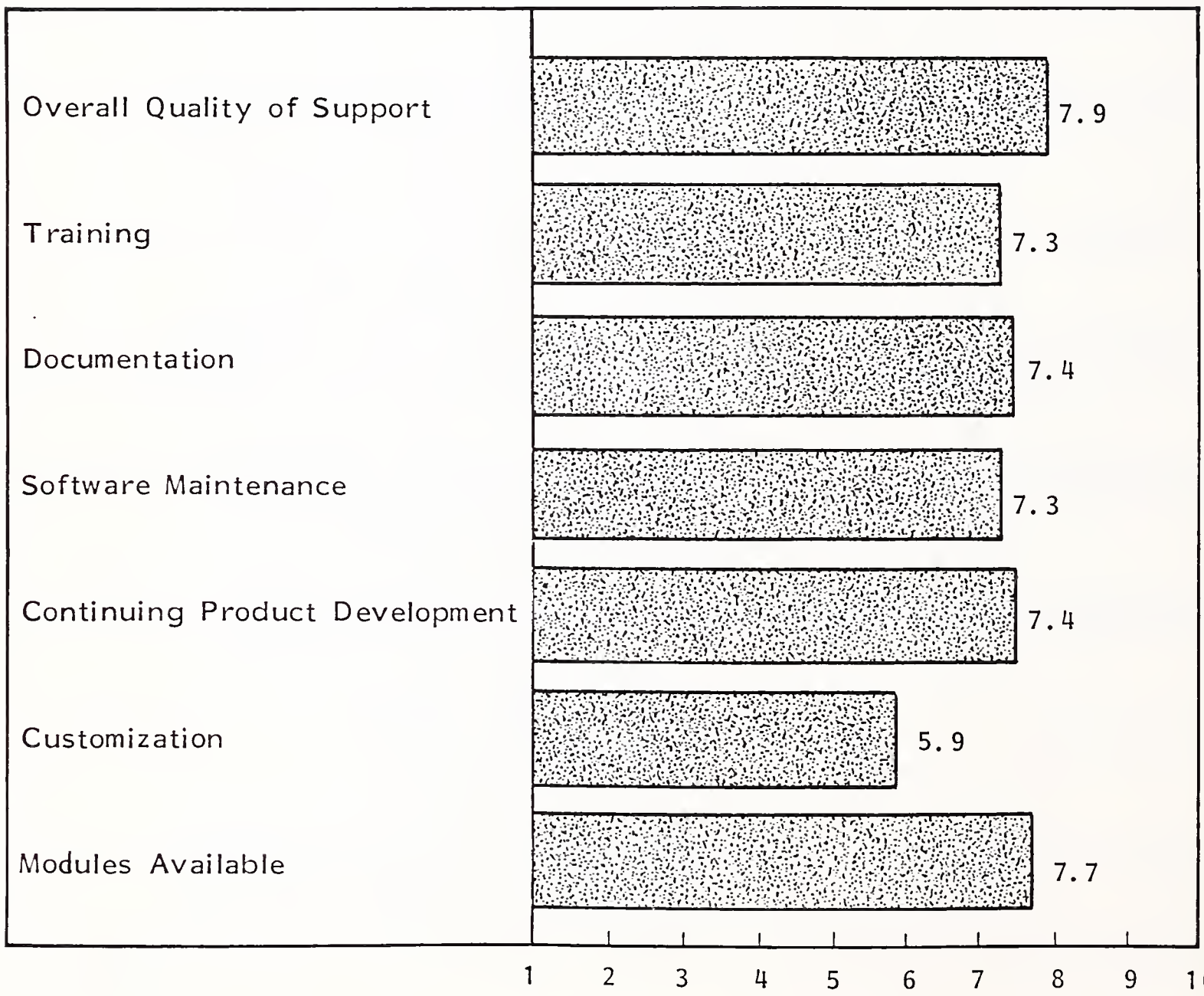
AVERAGE USER SATISFACTION WITH SUPPORT FROM COMSERV



Sample Size: 15 COMSERV Users

EXHIBIT V-7

AVERAGE USERS SATISFACTION WITH SUPPORT
FROM COMSERV'S COMPETITORS



Note: COMSERV Competitors' Users Surveyed were From the Following Vendors: ASK, Cullinet, IBM, MSA, Martin Marietta, and NCA

Sample Size = 21

Scale: 1 = Low, 10 = High

- When a Comserv user was also experienced with a competitive product, the user rated Comserv support higher, such was the case with four Comserv users who also had experience with IBM COPICS. Exhibit V-8 shows that Comserv users that have also used IBM COPICS rate the AMAPS program and support much higher.

D. USER ANALYSIS OF COMSERV'S COMPETITORS

1. ASK COMPUTER

- Ask ManMan users reported the shortest decision times for choosing their manufacturing systems, with a mean lag time of seven and a half months. Users were very impressed with Ask's reputation, along with the completeness of the package, including its report-writing capabilities.

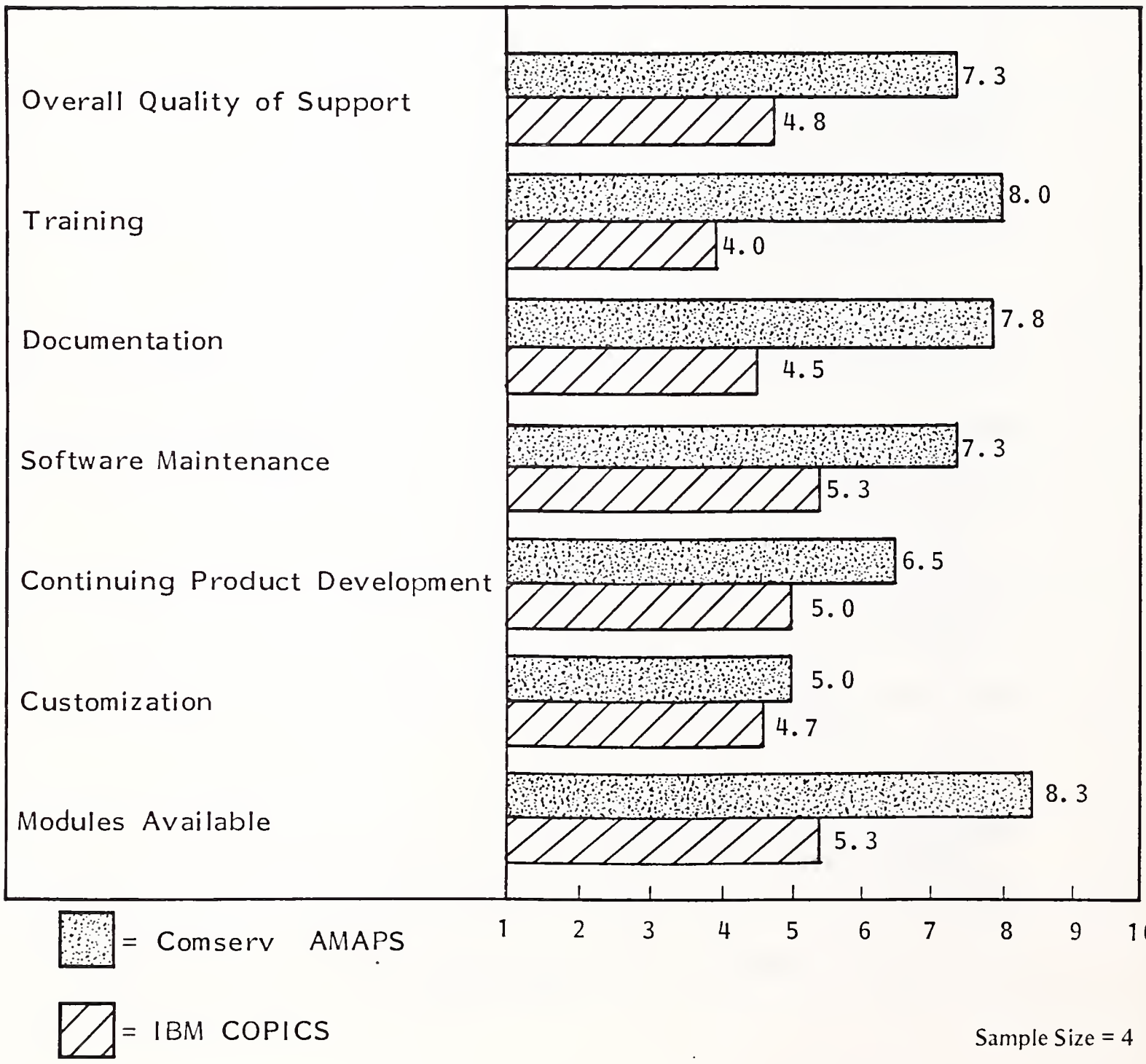
- Ask's reputation was so much a factor in the decision-making process that all Ask users surveyed did not even bother to do a cost justification analysis prior to purchase. The potential return-on-investment is highlighted in the ManMan product literature, however, which might have contributed to the user's confidence in the financial benefits of the program.

- Participants in the decision-making process most often included the MIS manager, the director or vice president of finance, and the director or vice president of manufacturing. Of these three, there was no clear cut weight of authority demonstrated.

- Ask users were less likely to purchase additional support from their vendor, and, if they did, spent far less on average for any additional support selected. The Ask survey group averaged only $11,000 per year maintenance expenditures and only $2,000 per year training expenditures.

EXHIBIT V-8

USER EVALUATION OF COMSERV AMAPS VERSUS IBM COPICS



Rating: 1 = Low, 10 = High

- Ask received consistent ratings from their users in the seven post-sale support areas tested in the user survey, with best scores in product development and modules available and lowest in customization (as was the case with most vendors).

- Exhibit V-2 provides complete Ask ManMan user satisfaction ratings.

2. CULLINET

- At the time that most of the Comserv users who are already installed and operable were testing software, Cullinet's product was very immature and untested, thus Cullinet's Manufacturing Software (CMS) was not as seriously considered by Comserv users as other packages. However, on the basis of current Cullinet user responses to the quality of the support available and an arguably functionally superior product, Cullinet appears to be Comserv's main competitor for the IBM and plug-compatitive marketplace.

- The Cullinet sample reported the shortest length of time with their software, averaging just over 19 months experience with their software. The comprehensiveness and expanded functionality of the package contributed to one of the shortest decision times, 14 months, of all the vendors (only Ask users took less time). In addition to the functional advantages of the packages, users found that CMS provided both the inventory reductions and improved labor productivity that encouraged them to consider MRP-type software.

- Cullinet users were more cognizant of the financial situation of the vendors. Comserv was already having difficulties during the time that some of the Cullinet users were evaluating software, and two users, reported that they eliminated Rath and Strong's packages due to the relatively small size of the vendors.

- The completeness of the CMS progam is matched by the quality of support reported by Cullinet users, who rated documentation, software maintenance,

and product development very highly (each received a nine) and training, modules available and quality of support just slightly below the previous three.

- Exhibit V-2 provides complete detail of Cullinet CMS user responses toward post sale support.

3. IBM

- As with many other purchase decisions, the principal reasoning behind choosing IBM's COPICS manufacturing software was name recognition, so much so that two of the three users surveyed did not even consider any other package, despite the fact that COPICS is functionally inferior to all of the other manufacturing software products surveyed for here.

- In contrast to most of the other software packages being evaluation, IBM COPICS selection was handled by top management, usually involving numbers of the executive staff. This contributed a decision-making period that lasted on average 16 months, which is comparatively long considering that IBM's software was the only package under consideration.

- The incompleteness of COPICS is reflected by the relatvely low user rating (shown in Exhibit V-2) in the area of modules available (7.0) and the very low rating (6.7) in continuing product development.

- Areas that the COPICS users rated highly include documentation, software mainttenance, and overall quality support, which are traditional IBM strengths.

- All of the COPICS users were leasing their software, making it impossible to analyze additional costs of support, since support costs are bundled into the lease charge.

4. MANAGEMENT SCIENCE AMERICA (MSA)

- At one time, MSA had been Comserv's chief competition in the IBM environment. MSA users reported the longest experience with their manufacturing software packages MRP and MRP II, averaging 36 months experience with their software.

- Users were originally drawn to MSA's package, which at one time was marketed by Xerox under the Arista name, due to the flexibility and completeness of the package under MSA. The users were additionally impressed by the quality of the people. MSA, both in their knowledge of manufacturing and in their financial background.

- After evaluating the MRP II program in comparison with other packages, the MSA users found it more flexible and easier to use than most, including Martin Marietta's MAS II and Comserv's AMAPS.

- Most often present in the decision making process were management representatives of operations, manufacturing, production control, and MIS, with the weight of authority evenly split between these representatives.

- MSA users frequently purchased additional support from their vendor. Three of the four MSA users surveyed purchased customization from their vendors, averaging $55,000 in customization expenditures. It is in the customization area that MSA excelled, as MSA users rated their vendor the highest of all users surveyed with a 7.3.

- MSA also excelled in training (with a user rating of 8.3) product development (with a user rating of 8.0) and documentation (with a user raing of 7.8)

- Complete MSA MRP II user ratings of vendor support are presented in Exhibit V-2.

5. MARTIN MARIETTA

- With a decision time of 24 months, Martin Marietta MAS II users took the second longest time making a decision after Comserv's 27.2 months. During this time, MAS II users surveyed performed what might have been the most intensive cost justification analysis of all the survey group. All three users surveyed projected costs savings over the installation period, and all found that payback occurred much sooner than original estimates.

- Involved in the evaluation process were most often MIS directors, special manufacturing information systems representatives, and representatives from finance, marketing, inventory control, material control, and production control. Although the actual purchase decision evolved from the committee, the MIS director often had most power in the committee's decision.

- As shown in Exhibit V-2, Martin Marietta user surveys reported the lowest satisfaction with post sale support and of their MAS II product in four crucial areas; documentation, product development, software maintenance, and overall quality of support. In addition, users gave Martin Marietta a very low rating for customization, which is compounded by the fact that one user was sold on the vendors customization expertise, and in fact spent $200,000 on customization service.

6. NCA

- Since NCA's Maxcim software program runs on DEC VAX equipment rather than IBM or HP computers, NCA competes indirectly with Comserv. In fact, all the users surveyed eliminated most of the vendors in this report due to fact that only Maxcim and Ask's ManMan programs ran on their equipment.

- NCA users reported decision times that averaged near the top of the range. During this decision time, return on investment analysis were performed, not as much as a vendor comparison, but rather comparing in-house costs versus

outside processing costs. This no doubt results from NCA's firm lock on the DEC VAX market place.

- Of the NCA Maxcim users surveyed, the vice president of finance was most often involved in the decision making process; however, the MIS manager, followed by the vice president of operations, had the most decision-making authority in these companies.

APPENDIX A: USER QUESTIONNAIRE

USER QUESTIONNAIRE

1. When did you make the decision to install a manufacturing software system ?

   - How long have you been using the system ?

2. What was the principal motivating factor ? (e.g. need for greater control of operations, greater integration, faster access to operational data etc)

3. Why did you choose (vendor name:)?

4. Did the vendor's actual performance meet your expectations ?

5. Did your company do a cost justification analysis prior to making the purchase?

   -If so, how was this done ?(What was it based on, what parameters were used, what did the analysis show ?)

6. Which vendors other than the one chosen did you consider ?

VENDOR	REASON NOT CHOSEN
1.	
2.	
3.	
4.	
5.	
6.	
7.	

7. Please rate (on a scale of 1=low, 10=high) the support available from the vendors in the following:

ITEM	SCORE OF vendor chosen	2nd choice	3rd choice
Overall quality of support			
Training			
Documentation			
Software maintenance			
Continuing product development			
Availability of customization			
Modules available			
Other( )			

8. Which modules of the chosen vendor's package do you use now ?

9. Why ?

10. Do you have plans to add others in the future? Which ones?

11. When you evaluated vendors did you take into account their financial situation ?

12. How many people participated in the decision making process (by title) and what was the importance of their opinion ?

Title	Weight of opinion(1=low,5=high)
=====	==========

13. Did you : o Purchase o Lease the product ? (o)

14. How many copies / licenses does your company currently have ?

15. Which additional modules do you intend purchasing ?

1.
2.
3.
4.

16. Did you purchase any of the following separately ?

ITEM	Yes	$Value(approx.)
support		
training		
documentation		
software maintenance		
customization		
other( )		

Thank You for your time !

APPENDIX B: VENDOR QUESTIONNAIRE

VENDOR QUESTIONNAIRE

1. Which manufacturing markets does your company serve ? (Note : if the vendor does not raise the subject of CIM(computer integrated manufacturing), mention it then ask him to define what he understands by that term).

2. How does a user, who is already using materials requirements planning (MRP-1), make the transition to your product ?

3. Same question regarding CAD/CAM (computer-aided design/ computer-aided manufacturing)?

4. Same question regarding Factory Floor(which includes capacity planning shop order routing etc)?

5. What is your company's strategy in targeting the manufacturing software market (in terms of size of company targeted, functions within the company that are or will be served, intentions the company has of integrating the functions served etc).

6. Describe the market as you see it today (is it still growing at the same rate as when the company first entered it, is competition more fierce, do users have different requirements now, is the market more price sensitive than before ?)

growth

competition
==========

user's requirements
==========

price sensitivity
==========

7. Do you plan to extend the functional coverage of your manufacturing software in the near future or is the product you have now functionaly frozen ?

8. Please rate your competition (strengths / weaknesses):

	Vendor	Strengths / weaknesses
1.		
2.		
3.		
4.		

9. What, in your opinion, is the current $ size of the market ?(Define which market is referred to):

10. What is your share of that market ?

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11. What, in your opinion, will be the $ size of this same market in five years time ?

12. Are you committed to any vendor(s) hardware ? (If so, which)?

    System software (e.g. Operating system)?

13. Do you plan, (and if so how) to integrate or otherwise use personal computers in your manufacturing software system ?

    -functioning under which operating system ?

14. Do you plan, and if so how, to integrate engineering workstations in your manufacturing software system (e.g. H-P 9000) ?

    -functioning under which operating system ?

15. What role (if different) do you see the new IBM PC AT playing in your product offerings ?

    - in the manufacturing application software market as a whole ?

Thankyou for your time !

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